Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "THE ELECTRICAL ENGINEER."

VOL. XXXIV. NEW YORK, SATURDAY, DECEMBER 23, 1899. No. 26.

PUBLISHED EVERY SATURDAY BY

ELECTRICAL WORLD AND ENGINEER

(INCORPORATED.)

120 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 4044 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

J. M. WAKEMAN, - - - - President and General Manager.

EUROPEAN OFFICE, - - - - - - - A. C. SHAW, Manager.
Hastings House, Norfolk St., Strand, London, England.
CHICAGO OFFICE, - - - - - - - 936 Monadnock Block.
PHILADELPHIA OFFICE, - - - - - - 929 Chestnut Street.

T. C. MARTIN AND W. D. WEAVER, - - - - - - - Editors.
T. R. TALTAVALL, - - - - - - - - - Associate Editor.
CARL HERING, - - - - - - - - - - Special Contributor.

NOTICE TO ADVERTISERS.

Change in advertisements intended for a particular issue should reach the office of the ELECTRICAL WORLD AND ENGINEER on or before MONDAY morning of the week of issue. New advertisements can be received up to 10 A. M. of Tuesday of the week of issue.

The first issue of each month is an export issue, having an extraordinarily large foreign circulation in addition to the regular domestic and foreign circulation of this paper.

TERMS OF SUBSCRIPTION.

United States, Canada or Mexico . . . . . per year, $3.00
Foreign Countries within the Postal Union, ... 6.00
Single Copies, ...10
In requesting your address changed give OLD as well as new address.

(Entered as second-class mail matter at the New York Post Office.)

NEW YORK, SATURDAY, DECEMBER 23, 1899.

CONTENTS.

	Page
Editorial	959
The New Common Battery Bell Telephone Exchange, Brooklyn, N. Y.	963
Early Work in Transmission of Messages Under Water	966
A Record-Making Automobile by J. B. Entz and H. P. Maxim	967
An Electric Drawbridge at Boston, by W. S. Key	969
Alternating Current Diagrams, by Robert A. Philip	970
Lighting the Trolley Bridge at Niagara, by Orrin E. Dunlap	973
The Grand Rapids (Mich.) Municipal Central Station, by Edward James Hart	973
Exhibits for the Paris Exposition	975
Current News and Notes	975
LETTER TO THE EDITORS:	
Incidental Uses of Series Field Windings of Compound Dynamos, by W. A. Anthony	976
Digest of Current Electrical Literature, Compiled by Carl Hering	977
New Book	982
High Grade Transformers	982
Williams-Abbott Improved Telephone Apparatus	982
Electrical Musical Instruments	983
Electricity in Textile Mills	983
Electrically Driven Profiler	984
American Machinery Exhibit at Paris	984
DEPARTMENTS:	
Financial Intelligence	986
Commercial Intelligence	986
Special Correspondence	987
General News	991
Personal	992
Obituary	993
Legal	993
Trade and Industrial Notes	993
Illustrated Record of Patents	993

AN ELECTRICAL AUTOMOBILE RECORD.

We print elsewhere a report of a recent trial of an American electrical automobile, during which the best previous record on one charge of battery was surpassed, with a large margin on which to hold the record. As noted in the article, the previous record was on a run of 84.4 miles at an average speed of 11.6 miles per hour, the battery weighing 2000 pounds. The present one was earned on a run of 100 miles at an average speed of 12.9 miles per hour and with a battery weighing 980 pounds. Lacking complete data for the former vehicle, a comparison on the basis of battery weight cannot be made, but the important fact remains that the American vehicle on one battery charge ran 15.6 miles further at a speed 1.3 miles per hour greater—and at higher speeds even slight increments mean much with respect to increased consumption of power. An interesting item of the data is that relating to cost of power. At the rate of 6 cents per kilowatt-hour, the cost of charge was but 1¼ cents per mile of run, or $1.25 for the entire course of 100 miles—a figure that should make the livery stable man feel uncomfortable. Moreover, the rate of 6 cents per kilowatt-hour can be materially reduced in the case of a large station designed solely for furnishing current to automobiles. Even in the case of a central station, a lower price is possible if the matter of automobile supply is systematized, and freed from the fixed and other charges that clearly belong to the lighting and distributing power departments.

MODERN TELEPHONY.

In one of the articles in this issue will be found an interesting account of the new common battery Bell telephone exchange which has just gone into operation in Brooklyn. Aside from the fact that the exchange is one of the first, as well as the largest, of this type to be put into operation along the Atlantic seaboard, it brings out one or two other features of note. There is first of all the resolve shown to render the service absolutely free from all possibility of breakdown or interruption and to eliminate all elements of physical danger from the system. But more striking even is the fact that large as the central or "Main" exchange is, a minority of the subscribers are directly connected to it. A glance at our map of the boroughs of Brooklyn and Queens will show that the New York & New Jersey Telephone Company has within that part of its territory no fewer than 22 exchanges. At one time in telephonic development, the tendency towards large concentrated exchanges went so far that had it continued we should have seen to-day the 10,000 Brooklyn subscribers in that region bunched on one or two big boards instead of thus finding themselves interconnected through more than a score. The system has no doubt gained greatly in flexibility and in economy of operation, but you will still hear big exchanges spoken about with an accent of pride and wonder, as though the mere size had anything to do with the intrinsic merits and problems of the situation. In fact the big exchange that does the whole business and is not fireproof is far from being wholly praiseworthy.

SUMPTUARY LAWS.

It was to be expected that some obstacles would be encountered in trying to obtain permission for the entry of electric automobiles

into Central Park and similar resorts. Ignorance, prejudice, conservatism and the very imperfection of the new apparatus always stand in the way of an invention or improvement, and it was certain from the start that automobilism would prove no exception to the rule. Our own idea was that perhaps it might be best after all to abandon pressure upon the obstructive authorities and to let the innovation make its own steady advance, as it needs must, with irresistible force. But when after a little foolish trifling, the New York Park Board actually began to issue permits for pleasure automobiles, we thought the cause already won. We were mistaken, for the whole case has been reopened in a manner that provokes alike indignation and laughter.

It appears, according to the details given elsewhere in this issue, that passes have been revoked that were granted for pleasure automobiles, on the ground that "Cabs and coaches, for the present at least, are objectionable. Open pleasure vehicles of the Stanhope type are permitted to be used under the present permits." Another new permit just issued runs: "To enter upon and pass over the drives of Central Park with an open electric carriage (phaeton) operated by an experienced motorman. Revocable at any time and subject to the rules and regulations of the department. In accepting this permit the holder agrees to exercise the greatest possible care to avoid frightening horses on the drives or bridle paths, or causing any danger or annoyance to the other frequenters of the Park." Thus, it will be seen the Park Board insists that while it will allow electric pleasure automobiles, they must be of the open Stanhope or phaeton types.

Things have come to a pretty pass when such sumptuary laws as these can be inflicted upon an intelligent community. One of the well-known gentlemen who was submitted to this kind of contumely was held to violate the terms of his permit because his wife and two children were driving in the Park in a closed coach, in care of a trusted and experienced motorman. Fancy compelling delicate women and children to ride in an open, exposed vehicle in the coming months of January, February and March, without protection from the inclemency of the weather! All kinds of horse-drawn cabs, coaches and hansoms frequent the Park to-day, some owned and many hired, and we would like to know how the public would take an edict insisting that every one of these enclosed vehicles should be given up in favor of open vehicles. The Park Board or public authorities trying to enforce such a foolish ordinance could not survive for one week the storm of universal indignation; and it is only because automobile users are still relatively so few that a protest of equal volume and intensity does not break out now. But the end of it all will be just the same.

The Flurry in Stocks.

So closely is the welfare of this country interwoven with that of England, that once again within the short period of four or five years, our markets have moved responsively to hers, and the movement here as much automatic perhaps as sympathetic has produced a range of prices for stocks and bonds far below that lately prevailing. In fact, England with her stolid and even stupid imperturbability has confronted passing disaster with comparative serenity, while the markets here with wonted sensitiveness have gone all to pieces. England in her long career as a civilizing power has lived and grown through many dark hours of storm and stress, and the marvel of it all is that none of these great responsibilities move her more than they do. She has become accustomed to it all, as this country will some day. In the meantime we can but regard the existing flurry in stocks as but momentary, and as quite healthful on the whole. Speculation was getting much too rampant and was beginning to invade the domain of industry in an ominous manner. A halt having been called in the rush to become rich anyhow, the preferability of making money by hard work and honest trading is once more plainly in evidence.

Control of Submarine Cables.

Last week we called attention to the passage in President McKinley's message to Congress recommending that support be given immediately to an American cable to the Philippines and the Far East. In view of the growth of American interests in that part of the globe, the recommendation is entitled to the gravest consideration and the most hearty support, but it begins to look as though the idea of national, subsidized cables might be pushed a little too far, reducing the whole cable system of the world to the basis of an overcapitalized and overstocked industry that could not possibly pay its way while so many people competed for patronage. Germany is already known to be contemplating the establishment of a submarine cable system of her own, although its extent is not indicated. Now France is harping on the same theme. The governor of French Indo-China wants to lay a cable from Saigon to Port Arthur, the Russo-Chinese possession, in order to clear English territory, and the Paris *Figaro* remarks: "Franee may be cut off from her possessions in India at any moment. This is entirely unnecessary. There need not be such great discrepancy between the number of cables owned by France and those owned in Great Britain. From a financial point of view, cables are a good investment. The British cables, which cost something over $160,000,000, pay now $22,000,000 to $25,000,000 a year, hence there is ample room for competition, especially as a lowering of prices would undoubtedly increase business." The Dutch colonies also propose to connect with Saigon, and probably Russia would be heard from if she did not have the advantage of an all land route. It is impossible not to be impressed with the manner in which these schemes group under the Franco-Russian leadership, while the English and American plans also come together with equal naturalness and would seem to require only German co-operation to render them complete and effective. Be this as it may, the new era of cable-laying looms big for the manufacturer and expert.

Paralleling Compound-Wound Dynamos.

In a letter on another page of this issue Prof. Wm. A. Anthony takes the stand that the throwing of an unloaded compound-wound machine in parallel with another under load does not alter the voltage of the latter. The argument is of course true for machines compounded for constant potential, but is not true for machines which are overcompounded. With a machine wound, let us say, for a rise of voltage of 10 per cent. at full load, throwing off half its load of course reduces the voltage about 5 per cent. Mr. Anthony's letter is an argument for the paralleling of machines in the old way by means of one triple-pole switch as against the more modern method of paralleling by means of one double-pole switch in the equalizer and positive leads, followed by the closing of a single-pole switch in the negative lead.

The difficulty involved in paralleling highly overcompounded machines of modern type with close speed regulation, slow armature reaction, stiff fields and small internal resistances, may be illustrated by the following suppositious case: Assume a railway power plant with one such machine wound for a 10 per cent. rise of voltage at full load, carrying its full rated load of, let us say, 1000 amperes, and delivering 550 volts. As the load rises it becomes necessary to throw in another machine in parallel with it. If this operation is carried out on the plan indicated by Mr. Anthony, the fresh machine would be excited by its shunt field up to 550 volts. On closing the triple-pole main switch of the fresh machine, its series field will be

ENGINEERING SOCIETY LIBRARY, UNIVERSITY OF MICHIGAN

thrown in parallel with that of the machine already loaded, and will begin to take over some of the current. Assuming that the series fields of the two machines have the same resistance and the equalizer and positive mains are of sufficiently low resistance to place them in a perfect parallel connection with each other, the voltage of the fresh machine will rise to about 575 volts and the voltage of the other machine will fall to about 525. This is neglecting the bend of the magnetization curve which will reduce this difference slightly. The result will be a complete transfer of the load from one machine to the other, which, however, as a rule, is gradual owing to the slow transference of the current from one series field to the other, and in turn due to the high ratio of self-induction of the resistances of these circuits. On account of this slow transference the attendant can as a rule check it by manipulating the shunt field rheostats, but in case of faulty equalizers, poorly adjusted governors, or other troubles, the manipulation of the machines proves very difficult.

If the attempt is made to adjust the voltage of the machine to a lower value than that of the busbars before throwing it in, the fresh machine when thrown in by means of the triple-pole switch, acts heavily as a motor until its series field gets part of the outgoing current. If there is any fault in the equalizer, this motor current will back up through the series coils of the fresh machine, and still further weaken its field and cause disastrous consequences. In case the series field of the fresh machine is thrown in before its armature circuit is closed, the voltage of the other machine will fall off materially unless its field rheostat is given a twist to build up the shunt field as the series field builds down, which may readily be done owing to the slow transference mentioned above. The voltage of the two machines may then be adjusted to equality and the negative switch of the fresh machine closed without the transference of a single ampere. The load may then be changed off from one machine to the other by manipulating the two field rheostats.

THE GEOMETRY OF ELECTRIC CIRCUITS.

The article upon "Alternating Current Diagrams" printed in this issue, contains an interesting geometrical proposition that, while quite general in its application to circuits at large, would probably never have come to light if alternating currents had not become utilized. We have all long recognized that the master key to the solution of any problem in complex circuit networks was provided by Kirchoff's two laws. The first is that the total difference of potential around any closed loop is equal to its line integral of the electromotive force; the second is that the sum of the currents entering or leaving any point must be zero. These laws were enunciated for continuous-current circuits, but they are just as applicable, by vector extension, to alternating-current circuits, as has been recognized for some time. Consequently, if we form a polygon of electromotive forces and differences of potentials in any closed loop, the polygon must close up. Similarly, if we form a polygon of the currents entering or leaving any one point, that polygon must also close up.

These propositions have been further developed in Mr. Philip's article with the result that by plotting potentials and currents for a network, we obtain two diagrams which are mutually conjugate and which possess remarkable geometrical properties. Some of these properties are pointed out. For example, any mesh in one, corresponds to a branch point in the other. The quantitative study of alternating-current circuits has been markedly simplified by the application thereto of vectors, or the geometry of two dimensions. By the aid of "complex quantities," the complete behavior and analysis of a complicated alternating-current system can often be worked out in as many minutes as would probably have taken hours by the archaic pre-existing processes. Direct-current circuits are aptly represented by the geometry of one dimension, or of straight lines following a single direction. Alternating-current circuits find fit and adequate representation in two-dimensional geometry, the geometry of a plane. Wireless telegraphy, and non-circuital electricity generally, seem to require tri-dimensional geometry for their analysis and explanation. Mr. Philip's conjugate geometry can evidently be developed much further. It is, however, already fairly intricate, and it seems impossible to judge whether further extension will be repaid by any practical application. Meanwhile, we are accustomed to recognize that any figure in space of a given number of dimensions is the shadow of some figure in dimensions of number one higher. But the conception in plane geometry of two figures, any branch point in one of which definitely corresponds to a mesh in the other, seems novel, and strange.

WIRELESS TELEGRAPHIC WAVES.

Many seem to find at first attempt a difficulty in picturing to themselves the genesis of a wireless wave, that spreads into space and acknowledges neither metes nor bounds. For that matter, however, there are many who do not clearly conceive of the genesis of waves strung on wires, doing our bidding in the electrical transmission of power. But that is another story. The fundamental phenomena involved in the production of an unwired wave are delightfully simple, although the precise detail of the action at each point and instant is still fascinatingly difficult.

Any electric or magnetic disturbance whatsoever, in any place, save a perfectly conducting envelope, like a sealed can at absolute zero, generates an electromagnetic wave that travels off in all directions with that velocity which is so neatly and aptly designated by physicists as "*v*." This is true whether we wave an electrified comb, waggle a permanent magnet, or excite a transformer into multitudinous magnetic oscillations. The only question of importance is in the energy of the radiated disturbance. That depends upon the mechanism. We have to wave a pocket dictionary very violently in the air before we recognize a sound emitted by the moving book. Less active movement of a walking stick will generate sufficient amplitude of disturbance in the air to make the movement audible, and, as we all know, a jerk from the wrist will make a whiplash generate so violent a local disturbance of the air as shall make itself recognized in a loud crack. But there was disturbance, and there was therefore sound, in each of the three cases. So, there can be no doubt that an excited transformer sends say 60 waves per second into free space each about 3000 miles long, or more than long enough to span the Atlantic. The local intensity, however, is so feeble that it is not likely that coherers would be affected at any distance from the apparatus. If they were, central stations would have to reckon invisible electromagnetic radiation as a noticeable waste of coal.

A suddenly demagnetized iron core in an induction coil can send out a disturbance of sufficient amplitude to affect coherers at a short distance, but what is wanted is the whip-crack of a much more sudden disturbance. Fortunately, a discharging electric condenser can produce oscillations so swift and sudden, in the neighborhood of the discharging circuit, that a powerful wave is emitted. A Hertz oscillator while discharging shakes the ether in its neighborhood so violently that during the very brief interval of its discharge it may be working at the rate of many horses, i. e., many kilowatts. A sparkless oscillation from a high-tension source into or out of a condenser may also produce the impulsive shock upon the ether; but the quickest currents or electric motions that we can yet produce are those due to the natural discharge of a highly charged condenser, and this is always accompanied by disruption and a spark.

Combination of Telephone and Phonograph Apparatus.

As early as the first days of the telephone and the phonograph the idea of working them together was entertained, and, in fact, the two interests were conducted for a time in one office in New York City. The companies separated before 1880, and so far as known they carried on no further experiments together, although other people have been reported from time to time to have made the attempt to render the phonograph a practical recording attachment for the telephone system to be thrown in or cut out as occasion renders necessary. A special correspondent in Copenhagen, Denmark, under date of Dec. 2, now sends the following details as to the work alleged to have been done there by Mr. Paulsen, son of a well-known and wealthy lawyer there. It is stated that Paulsen, until a few years ago, was an employee of the engineering department of the Copenhagen Telephone Company. Naturally he had many facilities for experiment, but his associates did not know what he was about. Instead of the usual phonographic wax cylinder Paulsen supplies a steel ribbon. Whereas it is necessary to plane off the wax on the ordinary phonograph Paulsen's phonograph needs only a cloth to rub off the writing, which does the "talking" as easily as if it was that much chalk on a blackboard.

The only reasons why experiments in this direction met with failure was because it involved too much trouble to record the message on the wax cylinder. The feasibility seemed apparent enough. But until Paulsen appeared no value could be attached to the experiments. The young man has the reputation of being a thorough chemist, and it is not impossible that his knowledge of chemistry and its kindred arts has enabled him to overcome what has baffled others.

The apparatus is constructed so that a very small magnetic needle, which is influenced by the current of the telephone wire, governs a steel ribbon which in turn runs over two cylinders.

"These cylinders come in touch with the magnetic needle and the work is done. While the instrument is operating and a person talks into the telephone, the magnetism in the steel ribbon is influenced by the electric needle to such a degree that a perfect message is recorded. At the receiving end it is only necessary to let the steel ribbons pass later before the electric needle and the current will then reproduce the words sent over the wire. Just as soon as the message has been heard, by passing a magnet over the steel ribbon, the speech is wiped off immediately and the instrument is ready to receive messages again."

The experiments which have recently been made in Copenhagen have been so successful that a company has been formed to introduce the invention all through the world. Paulsen sold out his patent, and interested in the new concern are leading Danish men like bankers August Lunn and Lemvigh Fag. The new phonograph is a separate instrument, and if no use for it exists for some time it may be disconnected and placed to one side. It is arranged so that when some one calls up, should no one respond, the talker is at once made aware that at the other end there is only the phonograph connection. He will, therefore, frame his message accordingly. So far as the central station is concerned, no extra work is placed on the operators there. On the contrary, when a phonographic connection is present the operators will not be called upon as frequently as before.

The Independent Telephone Movement.

There are few new surface developments to record in the independent telephone movement recently started with headquarters in this city, but it is rumored that work has been pushed in many different directions and that estimates have already been asked for the first switchboard for the New York exchange, presumably to go into the Knickerbocker exchange, in the Astor Building, on Broome Street.

Efforts have been made to size up the various independent and local companies co-operating more or less with the movers in the national enterprise. The capitalization represented may be gathered from the subjoined list of the principal groups: Telephone, Telegraph & Cable Company, stock, $30,000,000; Knickerbocker Telephone Company, $5,000,000 stock; People's Telephone Company, $5,000,000 stock; Seashore & Delaware River Telephone, Telegraph & Cable Company, $100,000; New York & Philadelphia Telephone, Telegraph & Cable Company, $100,000; Continental Telephone, Telegraph & Cable Company, $25,000,000; New York & Boston Telegraph & Telephone Company, and the Massachusetts Telephone & Telegraph Company, $5,010,000 stock and $5,000,000 bonds; Federal Telephone Company, of Cleveland, stock, $10,000,000; Cuyahoga Telegraph & Telephone Company, $3,000,000 stock and $3,500,000 bonds; United States Telephone Company, $5,000,000 stock; Columbus Citizens' Telephone Company, stock, $1,000,000; United Telephone & Telegraph Company, Baltimore, $5,000,000 stock; Maryland Telephone & Telegraph Company, $1,250,000 stock and $1,250,000 bonds; Pittsburg & Allegheny Telephone Company, $1,500,000 stock and $1,500,000 bonds; Washington, D. C., Telephone & Telegraph Company, $1,500,000 stock; Delmarvia Telephone Company, Delaware, $150,000 stock and $100,000 bonds; Illinois Telephone & Telegraph Company, $5,000,000 stock; Mississippi Valley Telephone Company, $1,000,000 stock. These totals which are confessedly incomplete represent the formidable sum of over $110,000,000, but how much of it is actual investment none but the insiders know. It is, however, the fact that large sums are being expended or will soon be paid out in behalf of these various enterprises, chiefly where street railway capital is behind them. There are other new allied companies forming, it is said, such as the Interstate Telegraph & Telephone Company, of Philadelphia, with a capital stock of $2,000,000, and the Eastern Telephone & Telegraph Company, of the same city, in close affiliation, and other companies are reported to be forming in Connecticut and other states.

Automobiles in Public Parks.

The fight which is being waged to secure for automobiles the right to enter public parks has been intensified during the past week by the action of the authorities in New York City, in revoking the permits granted to Messrs. Isaac L. Rice and Jefferson Seligman, on the ground that "cabs and coaches, for the present at least, are objectionable. Open pleasure vehicles of the Stanhope pattern are permitted to be used under the present permits." In view of the fact that it is now the end of December, the insistence upon uncovered vehicles is simply absurd, especially when, as in the case of Mr. Rice, the automobile is used to carry his wife and little children for an airing in the park.

Such ruling as this cannot possibly go long unchallenged, and Mr. Rice has written Park Commissioner Clausen as follows: "I have hitherto fully respected your position in relation to the entrance of automobiles into the Park, as it was ostensibly based on your fear that they might frighten horses and thereby endanger the safety of the Drive. This fear proved groundless in my case, as I and my family entered the Drive three times, under the permit granted by you, without awakening the slightest attention of a single horse. This, indeed, was only what I expected, as it seemed incomprehensible to me that the horse—an animal whose good sense is proverbial—should not notice an automobile at Fifty-ninth Street, and be frightened out of its wits by it at Sixtieth Street simply because that happened to be under the control of the Park Commissioners.

"To-day, however, by your revocation of my permit, and your statements to the press, I find that your ostensible reason for objecting to automobiles is only a secondary consideration. It is not in your capacity as the protector of the public within the precincts of your jurisdiction, but as arbiter elegantiarum that you object to my carriage.

"In order to find favor in your eyes, apparently it is not essential that the driver be a man who understands how to manage the carriage (as I received my permit without any examination as to my ability to drive), but that he should wear no uniform; that he should prove and identify himself as the owner of the carriage; that the carriage shall not be old-fashioned [sic]; that it shall be of the Stanhope type, open, so as to afford no protection against the inclemency of the weather, etc. In other words, your position is not that of a public servant acting in the public interests, but that of a despot. If your authority as Park Commissioner allows you to make a regulation of this character, it must also allow you to place your hat in some conspicuous place and permit no one to enter the Park who will not bow to it.

"Your ruling, therefore, affects the rights and liberties of the citizen, for which I believe there must be a remedy."

If the objection be urged on the ground that Mr. Rice hires his vehicle from the New York Electric Vehicle & Transportation Company, it is to be borne in mind that a great many of the horse carriages of all kinds used in the Park are also hired out in an exactly similar manner from livery stables.

The New Common Battery Bell Telephone Exchange, Brooklyn, N. Y.

ONE of the most important and interesting telephonic developments in Greater New York has just been carried to a successful issue in the installation of its new central office, "Main," in Brooklyn, by the New York & New Jersey Telephone Company. This exchange is already in operation, and by the time the present article appears the great bulk of its subscribers will also have been equipped with the new apparatus, so that Brooklyn to-day

FIG. 1.—BROOKLYN'S NEW TELEPHONE EXCHANGE.

supplies, with its Main and Bedford exchanges based on the latest methods, the best illustration of modern Bell practice that can be found in this part of the country. The extent of the Bell network for which the new building on Willoughby Street serves as headquarters is really a matter of surprise. Besides the Brooklyn region, embracing a round 10,000 subscribers, the New York & New Jersey Company has throughout its Long Island, Staten Island and Jersey territories some 18,000 more, and to these again may be added those enrolled by the New York Telephone Company, so that the close of 1899 witnesses a total of Bell telephone stations within Greater New York region or directly tributary to it of very little short of 75,000.

The Brooklyn distribution of exchanges is illustrated by the map shown herewith, and it is the intention of this article to dwell especially on that field, and specifically, as already stated, on the new exchange headquarters.

The building itself, we may note in passing, is a very handsome Indiana stone and terra cotta structure, designed by the company's architect, Mr. R. L. Daus, in the style of the Italian Renaissance, eight stories and basement, fronting 108 feet on Willoughby Street and 100 feet on Lawrence. Hither the executive and engineering departments of the New York & New Jersey Telephone Company were moved from the Smith Street exchange building early this year, and now the whole top floor has been occupied, presenting one of the most stately and beautiful exchange interiors, with facilities unsurpassed for extent and for completeness of detail. Previous to the transfer, which in itself involved a revolutionary change from one board and one method of operation to another, it was necessary to duplicate the entire service of conduits and cables, so that the cables running into Smith Street were in the same manner represented by as many new lead covered cables, aggregating 12 miles, carried into the basement at Willoughby Street. The expense and work necessitated may be inferred from the fact that for over three months a score of linemen were at work over the short stretch of two or three blocks between the old office and the new, and in the basement, making and insulating in that time nearly 100,000 wire joints and completing 328 sleeve joints on the lead pipe covering. These minor points are mentioned partly because they are so often overlooked by the public in discussing the cost of telephone service; yet with all this figured in, the average Brooklyn citizen can now get his telephone service as low as $24 a year.

The entry of the cables to the Willoughby basement and the splitting up of the circuits there is shown in two of our views, one of which illustrates the entrance of the cables from the streets and the other the distributing racks. There are 156 pipes at the cable entry, and, as already noted, scores of cables have been brought in, some of them being 200 metallic circuit. The rack accommodates at present 12,300 wires, or 6150 circuits, and has lots of room for growth. What may be called the cable heads are ranged horizontally with the wires fanned out on cleats, whence they are passed across to the vertical frames equipped with heat coils, carbon lightning arresters, etc., on the other sides of the racks; the cables from the Brooklyn Elevated roads being kept in a class apart. Thence wool insulated cables run up a brick lined cable shaft to the operating room on the eighth floor, with access to the shaft at every floor. A good deal of supply material is carried in the spacious basement, although the third floor is practically a storage room also. In addition to connection to the Brooklyn Edison electric light mains, the company has a most compact power plant of its own in the basement, comprising three 50-kw Western Electric generators driven by three Ball & Wood engines. The two large elevators of the building are also driven electrically, there being two Elektron elevators of 2500 pounds capacity, equipped with two Perret motors, of 25-hp each. It is a curious though perhaps not a singular fact that the central office operating plant is upstairs in closest juxtaposition to the big board. The very idea would have thrown an early telephonist into a fit.

FIG. 2.—OPERATING ROOM IN THE NEW "MAIN" BROOKLYN, N. Y., BELL TELEPHONE EXCHANGE.

What he aimed at was to get his generating plant as far away as possible, lest he should knock out his service, and add to "cross talk," the crosser talk of subscribers.

At the upper terminal of the cable shaft, the cables are broken out again, as usual, into an intermediate rack, of structural steel, which is shown in one of the engravings, and which stands near the

racks carrying the relays, condensers, etc., on one side of the central office generating plant, all within a partition of wood and glass, and adjacent to the desks of the wire chiefs. This plant, as shown, consists of two Western Electric motors of 12-hp each direct connected to two charging generators of 7½-kw each of the same make; 11

FIG. 3.—VIEW OF THE TOLL BOARD.

type G17 Chloride accumulators furnished by the Electric Storage Battery Company, of 1250 ampere hour capacity; two ringing current motor generators and two trunk signal motor generators, these last four outfits being run from the storage battery, and the ringing generators having attachments for giving "tone test" and "busy back" test. The batteries are conveniently grouped within a large closet, for instant inspection and can be considerably increased in capacity. All circuits center in the neat slate switchboard, which by its combinations of current supply insures the exchange practically continuous operation, through all contingencies and emergencies. The large motor-generator sets run at 125 volts and deliver current on the other side to the batteries at 25 for the switchboard lamps, one of them operating on the house circuits and the other on the Edison street supply.

It is well understood, of course, that the intermediate rack, continuing the work of the distributing rack in the baesment, enables the central office manager to further assort and classify the work to be done by the individual operators. Each circuit after leaving the intermediate rack passes in cables again along the back of the switchboard throughout its length; at each section forming three operators' positions, the circuit being connected or bridged to a spring jack in

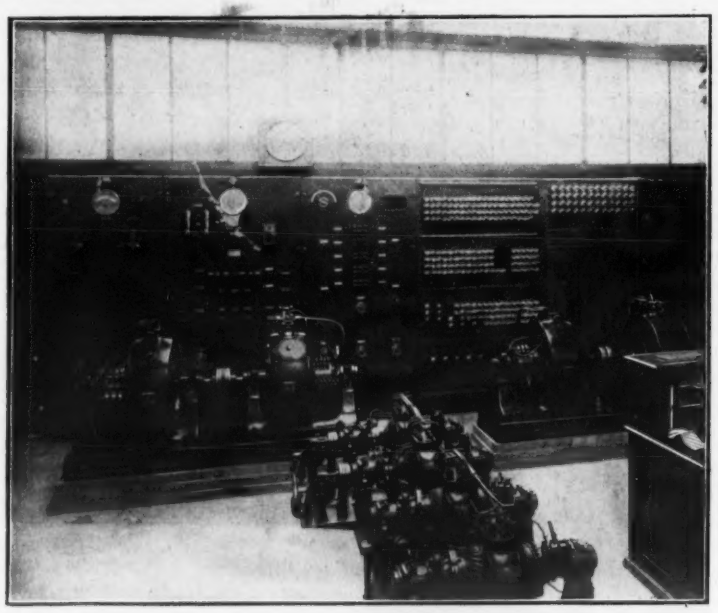


FIG. 4.—VIEW OF GENERATING PLANT.

order that each operator may have within immediate reach every subscriber's circuit in the exchange. This is the essential "multiple" feature. In the same cable and connecting to each jack in the same way is a third or "test" wire, enabling the operator who wishes, to connect into any number called for in the exchange whether that circuit is busy or not. Another set of cables starting out from the intermediate rack carrying the same circuits throughout the board terminates in groups at the operators' positions, where are located the answering jacks and the corresponding signal lamps placed immediately below the respective jacks.

We have now reached in due sequence the board itself in the operating room, a lofty, harmoniously proportioned apartment, well lighted from the ceiling as well as by numerous large windows. Several views of this room are here shown, the largest giving the full sweep of the semicircular board, flanked on the north by the generating room, stretching along the west wall and curving along the south, with three large monitor desks in the central floor space, auxiliary desks for toll charge slips, etc., and with the toll board occupying a larger part of the east side. Although 60 to 75 people will be at work here at a time, it is probably one of the quietest rooms in all Brooklyn. In the old distributed energy systems over and above the quiet inquiry of "What number?" etc., would be heard the castanet clicking of the annunciator drops, but with lamps for signals, all the clicking is done in the encased relays outside the room and away from the board. As the general superintendent remarks poetically but truthfully: "One wonders at the absence of noise. Soft light, like stars in the Milky Way, come and go over the surface of the switchboard, and only a quiet murmur of sweet feminine voices is heard." The board is equipped at the present time for 3500 subscribers' circuits and 500 trunk circuits, and has an ultimate capacity through the addition of

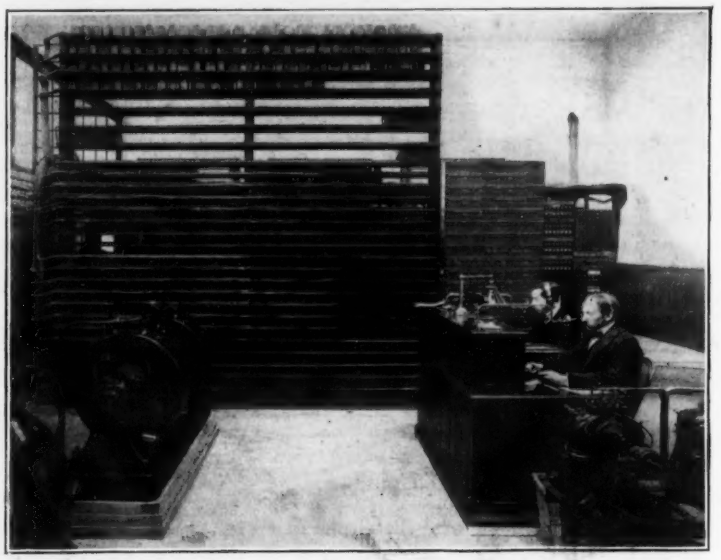


FIG. 5.—WIRE CHIEFS' DESKS, RELAY AND CONDENSER RACKS, ETC.

other sections and equipment for over 5000 circuits. The fitting up of this room with the apparatus to operate it and supply current, etc., the main and suburban toll boards, the desks of the manager, chief operator, monitors, etc., required a full year of constant labor. The board itself contains 53,370 spring jacks, 5005 lamps, 11 miles of cable, aggregating 612 miles of wire, and a total of 422,160 soldered joints distributed over the main and intermediate rack, relay and coil racks, switchboard and desks. The main board and toll board are both built of solid mahogany.

The general idea of a central battery switchboard with lamp signals is familiar to the readers of this journal, but a few brief sentences may be devoted to explaining how a call goes through in Brooklyn, taking two subscribers both in "Main," for example, Williams 5045, who wants Thompson 7550. Williams lifts the telephone from the hook at his station, and this allows the current from the storage battery at central to flow through his circuit, by means of the relay, and causing the small lamp to light up on the switchboard. The lamp is just below an answering jack which has Williams' number alongside it in small white figures, in the vertical part of the oard. The operator picking up one of the cords from the keyboard, or horizontal part, in front of her, pushes the plug at the end of the cord into the jack corresponding to the lamp, throws over a bridging key and asks "What number?" This operation cuts out the lamp on the Williams line 5045 and supplies the subscriber with talking current. Having received the order for 7550 the operator takes the other end of the pair of cords and touches the tip of its plug to the 7550 jack in the multiple before her. If she gets a click in her head receiver, she says "busy;" if the line is clear, she pushes the plug into

that jack and presses a ringing key which causes the bell at 7550 to notify the subscriber that he is wanted. Having finished their conversation, one of the parties (or both of them) hangs up the telephone on the hook. This action throws into circuit a supervising lamp in the front of the board and notifies the operator that the connection has been completed. The disconnecting supervisory lamps in the cord circuit light up, thus giving the operator an automatic notice to disconnect and clear both lines. Should one or both of these lamps flash intermittently, the operator knows that something further is wanted and will cut in again. Should Williams 5045 Main want a subscriber in another office or out of town on a toll line, the same operation is performed, except that the operator cuts in on an "order" circuit to the office wanted and gives the number required to a trunk operator, who calls up and connects the subscriber, say in Southampton, Long Island, or Paterson, N. J., or Richmond, Staten Island, or throughout Manhattan Island.

As far as possible, the various classes of service are grouped in the board, and the latter day complexity, as contrasted with the "sweet simplicity" of the old flat rate methods may be inferred from the fact that there are now at least eight distinctive kinds of lines, namely (1) message rate, direct line; (2) pay station, direct line; (3) message rate, party line; (4) pay station, party line; (5) flat rate, direct line; (6) flat rate, party line; (7) automatic pay station line, and (8) message rate and pay station party line. The old flat rate tends to oblivion and elimination in any such modern exchange as this, although part of it still lingers; but is succeeded by a system of dockets and bookkeeping which, while it yields the subscriber a scientific basis of exact service for so much money, hints at further coming refinements in the minimization of operators' work by automatic devices. In Brooklyn, as elsewhere, great care is taken not to overload any operator at any "position" on the board, causing delay in operation, so that while some girls have 100 lines of medium activity, another will have only 30 very active ones. The average number of stations per employee engaged upon the Main office force is slightly over thirty. The distribution of messages through an office varies with its location and the character of business, but ordinarily about 50 per cent. of the business is found to be local to the office, the remainder being divided up among other offices within and beyond the city limits.

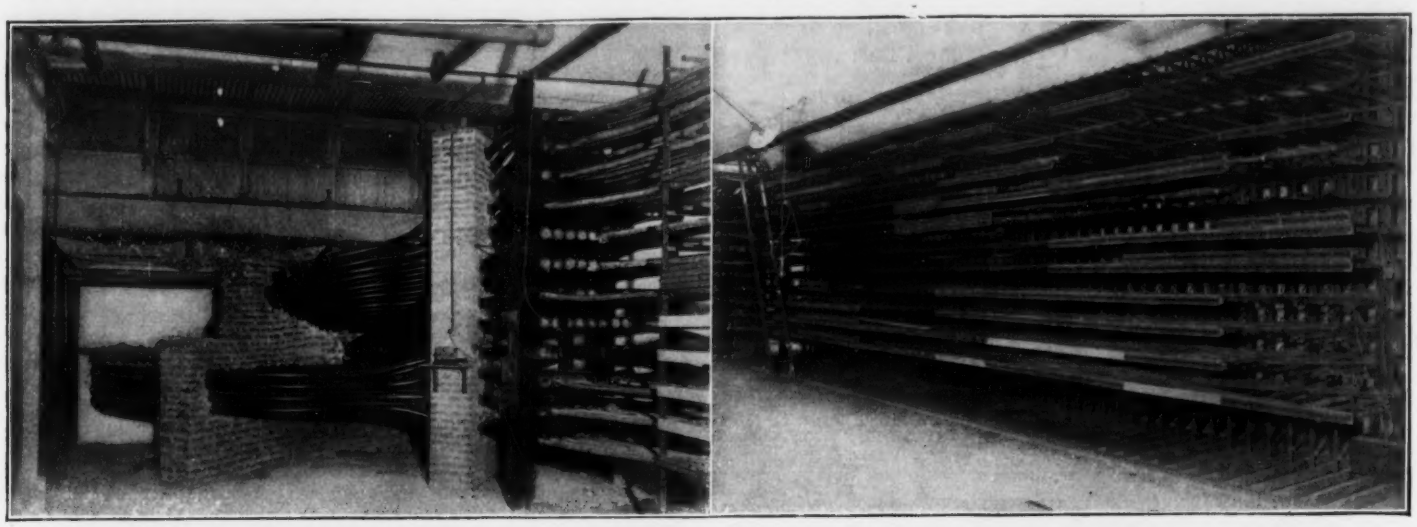


FIG. 8.—CABLE VAULT IN BASEMENT, SHOWING DUCTS, CABLES AND DISTRIBUTING RACK.

The different classes of service known as flat rate, message rate, pay station, etc., all require different methods in detail of handling, and so far as possible lines requiring the same class of service are grouped together on the board. To assist the operators also in keeping tab on their work and the charges to be collected, there are certain symbols used on the opal glass caps to the answering jack lamps. These are shown in one of our illustrations. In the Main office alone some 50,000 connections a day of all classes are handled. Calls local to the office are handled directly by the operator answering the call, in the manner roughly described above, but it must not be forgotten that incoming calls to any subscriber's station, unless upon the section controlled by the operator in charge of outgoing service, are handled by any operator at any other part of the board or room, without knowledge of the operator attending to the subscriber's outgoing calls, i. e., she will not know the line is engaged until it gives the "busy" indication when she tries to cut in. Calls for subscribers in other central offices are transferred to the trunk operators at the re-

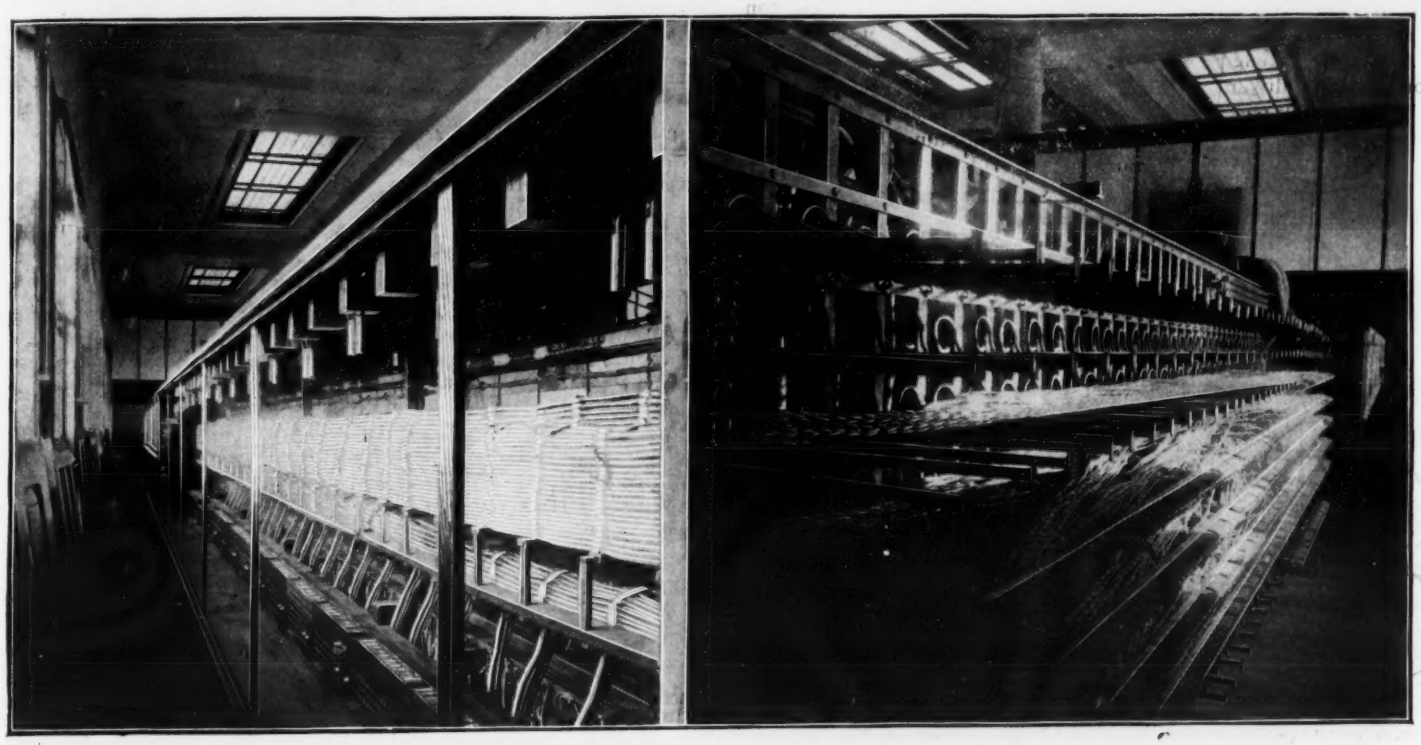


FIG. 9.—BACK OF THE LARGE SWITCHBOARD AND THE INTERMEDIATE RACK ADJOINING.

spective offices, who call up and complete connection with the called subscriber, an operation requiring the service of two girls and sometimes three. The calls for points outside Greater New York are handled through the toll board, of which a separate picture is shown, by means of a force of operators specially trained to handle this difficult and important service. The cables and pole lines ramifying over many hundreds of square miles in New York and New Jersey represent an investment of millions of dollars, and speedy service is needed to get any kind of return on it. Just now such sections of the toll

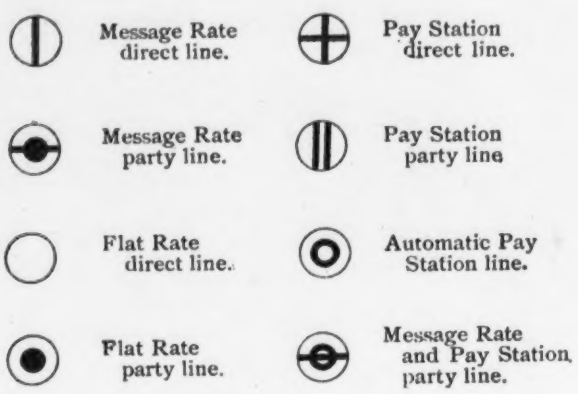

Message Rate direct line.
Pay Station direct line.
Message Rate party line.
Pay Station party line
Flat Rate direct line.
Automatic Pay Station line.
Flat Rate party line.
Message Rate and Pay Station party line.

FIG. 10.—SYMBOLS ON LAMP CAPS.

board as Coney Island or Long Branch are as lonely as the actual regions, but in the crowded short season the work is bunched in a tremendous fashion, taxing every human and electric nerve available, for the month or two of hot summer weather. A couple of dozen operators are steadily required at this toll board, which has in addition to the regular equipment of apparatus a complete outfit of the ingenious calculagraph at each "position" for figuring the duration of each connection. From time to time, special sections of toll board are temporarily necessary, with enormous expenditures in reaching the objective points, as, for example, when Camp Black was started on Long Island at the outbreak of the Spanish-American war, or when the returning troops from Cuba were quartered at

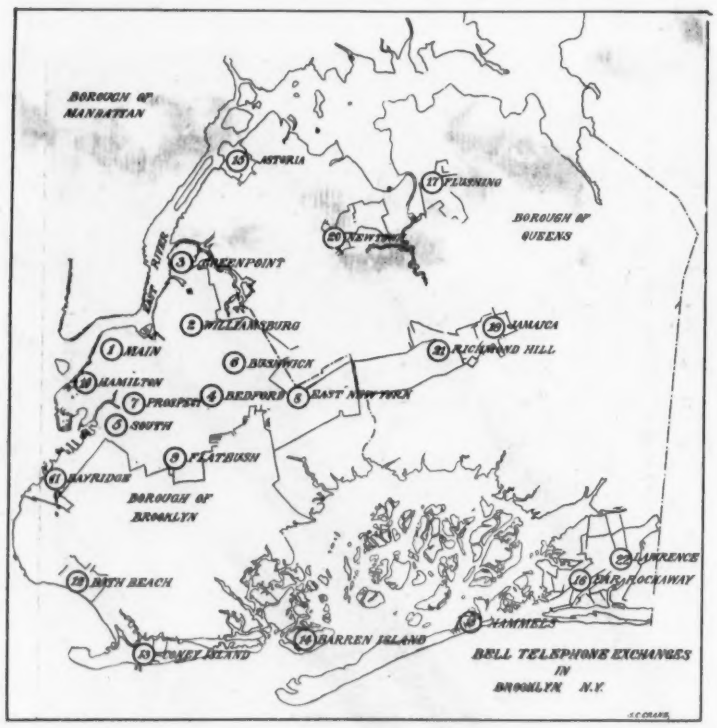


FIG. 11.—LOCATION OF BELL TELEPHONE EXCHANGES IN BROOKLYN AND QUEENS BOROUGHS.

breezy Montauk Point, and the whole nation yearned to feel their pulse every morning.

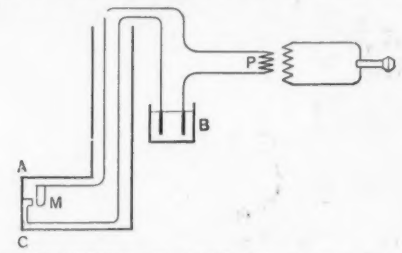
To expedite the current work, supervisors patrol the board incessantly, stopping at any position to check incipient delay or interruption of service, while each operator is required to transfer at once to the monitorial desks any special trouble or friction such as often occurs from accident or from absence of a subscriber. It would indeed do any telephone patron good to spend an hour around an exchange and see the anxiety with which the whole force instinctively throws itself on the conquest of any "busy" obstruction causing delay or annoyance. Moreover, it is obvious that the new central battery system thus adopted at Main, in Brooklyn, already in use also at the Bedford exchange there, and to be further pushed, minimizes the effort to be made by the user of the telephone. He has no longer to indulge involuntarily in calisthenic exercises with the handle of the magneto, and by the later developments of the service the instrument is brought to his desk or his bedside. In Brooklyn there are connected with the system some fifty private branch exchanges in offices, dry goods stores, etc., some of which have from thirty to fifty stations, and under the new régime these can reach a party through the intervening private branch board and "central" even quicker than two parties could be brought together, without such exchanges, through the old distributed energy multiple boards. Moreover, Brooklyn by means of the liberal provision made of trunks is in direct communication with all the New York City exchanges, just as though they were subsidiary units of its own network.

The operating room just described requires some 60 operators in continuous service, or about 100 all told for the various watches. For these, generous provision is made to secure their comfort on and off duty. The building also furnishes accommodation to at least as many more of the several hundred employees required by the company for the smooth and efficient operation of its great and growing system extending from the Long Island Sound far down the Atlantic seaboard and around the Hudson and the Passaic, of which vast territory our map includes in reality but a minor section. We are indebted for the data here given and for many courtesies extended in the preparation of this article to Mr. W. D. Sargent, vice-president and general manager, and Mr. J. C. Reilly, general superintendent, who inform us that by 1901 they hope to have all their exchanges converted over to the central battery system, with all the improvements that will have been suggested and worked out by that time.

Early Work in Transmission of Messages Under Water.

In the early part of 1883, Prof. Trowbridge conducted some experiments on the transmission of messages under water, which have a particular interest at the present moment in view of the recent issue of patents to Prof. Elisha Gray on a method along similar lines. The experiments had for an object the discovery of some method of obviating collisions at sea in a fog, and were carried on with the assistance of Prof. Alexander McAdie, now of the United States Signal Service.

Referring to the accompanying diagram, *M* was a microphonic contact in a water-tight box The face, *A*, of the box constituted a vibrating diaphragm, the vibrations of which were conveyed to the microphonic contact, *M*. The wires from the microphone, *M*, were conveyed to a battery, *B*, and then through the primary coil, *P*, of an induction coil. In the circuit of the latter was placed a telephone. The water-tight box was lowered into the water from the side of a boat. An assistant stationed on the bank made sounds under



TRANSMISSION OF MESSAGES UNDER WATER.

water by striking two stones together and by various other means, while Prof. Trowbridge listened at the telephone from a point up the stream. When he was distant three or four hundred feet or more, the sounds were transmitted to the telephone through the water. The same results were obtained when the sounds were made from a boat in the stream.

Means were taken to keep the pressure in the microphone box the same as that produced by the water on the diaphragm. With more powerful sources of sound, such as the sound of steam condensing in a pipe under water, messages were transmitted more than a mile under water.

A Record Making Automobile.

BY J. B. ENTZ AND H. P. MAXIM.

Some of the details of the electric automobile which lately brought the world's record for electric automobiles to this country may be of general interest and are given herewith.

The vehicle was one of the Electric Vehicle Company's Columbia vehicles built by the Columbia & Electric Vehicle Company. The storage battery with which it was fitted was made by the Electric Storage Battery Company. The object in building it was to determine the governing factors in the construction of a storage battery, motor, tires, bearings and running gear construction for a light-weight long distance electric automobile. The vehicle details consisted of standard parts of a Columbia runabout in the main. The wheels were 32 inches diameter forward and 36 inches diameter rear, had wire spokes and solid rubber tires. The wheels revolved on ball bearings of the two-point contact construction. The wheel gauge was the same both forward and aft. The wheel base was 65½ inches.

The rear axle was fixed, the driving wheels revolving upon it. The front axle carried the pivots for the steering wheels at each end. The two axles were connected by two flexible reaches positively maintaining parallelism of the axles, but allowing independent flexibility vertically.

The body was of wood and of Columbia Runabout style. It was mounted upon a forward and a rear spring bar, each carried by a full elliptic spring at each end. These springs were clipped to the axles at points as near the wheels as possible. The body carried the battery upon its floor, but the weight of the battery was taken directly by the spring bars and springs.

One motor was used and was mounted in a self-contained case, or "torpedo" and included the entire driving system; i. e., pinions, bearings for same, balance gear, motor, hollow motor shaft and bearings, etc. This "torpedo" or case was pivoted on the rear axle and supported vertically by means of a spring carried on the reaches. This gave the motor a spring suspension and maintained it at all times at the proper distance from the rear axles to keep the gears in mesh, as is customary in street car construction. The motor was series wound, designed for a capacity of 25 amperes at 80 volts and 1000 revolutions per minute. The gear reduction was single but each rear wheel was driven. The total weight of the vehicle ready for service without batteries was 1200 lbs. The total weight with the batteries was 2180 lbs. The total weight with the passengers and impedimenta, 2600 lbs.

The controller gave three speeds ahead and two to the rear. The necessary electrical instruments to take the readings desired were located on the foot board and possible of observation at all times. A 28-inch Veeder cyclometer was attached to the front right wheel, so that it could be easily read by the occupant of the right seat. The general appearance of the vehicle can be obtained from the illustrations.

The battery consisted of 48 cells of lead-lead storage battery, mounted in four separate boxes of 12 cells each. Each cell contained 11 plates. Each of the four battery boxes measured 38¼ inches long by 7¾ inches wide by 12½ inches high, and when mounted, sealed, connected and complete in every particular, ready for service weighed 980 lbs. The capacity of this battery, discharged at 22 ampere rate, was 154 ampere hours.

Fig. 1.—Awaiting the Word "Go."
Fig. 3.—50-Mile Mark and Distance Checkers.

Fig. 2.—Blocked at Railroad Crossing, Absecom.
Fig. 4.—Finish of the 100-Mile Run.

A RECORD MAKING AUTOMOBILE.

The first trial of this vehicle and battery occurred on Nov. 15th and consisted of a preparatory run from the station of the Pennsylvania Electric Vehicle Company at 250 North Broad Street, Philadelphia, to Atlantic City, N. J., from which it was intended to start an officially recorded test. The cyclometer reading at the departure from the station was .25 miles. At the landing in Camden of the Market Street Ferry, the cyclometer read 2.2 miles and the time 11:41 a. m. A route was followed leading from the Ferry landing to the White Horse Pike and thence over the route shown in map. Electrical, mileage and time readings were regularly taken, and a general idea of the consumption of energy may be judged by the following:

At the turning of the 22d mile (25 1-7 actually) the time was 1:29:20 and the voltage at a 22 ampere rate of discharge, 97 and the

watt hour expenditure 3.7 kw-hours, equaling 55.2 watt hours per thousand pounds per mile for a speed of 13.9 miles per hour. At Hammonton, 30 miles out, a stop and a side run were taken for lunch and in order to secure photographs. One hour and 31 minutes were consumed. At the turning of the 43d mile (49 1-7 actually) the time was 4:26:37 and the voltage was 96 at a 22 ampere discharge rate, the watt-hour expenditure was 2.82 kw-hours, equaling 46.6 watt-hours per thousand pounds per mile for a speed of 16.7 miles per hour. At the turning of the 60th mile by the cyclometer (68 4-7 actually) the time was precisely 5:45 p. m., and the location the Reading Depot in Atlantic City. The voltage reading was 95 at 22 amperes discharge rate and the watt-hour expenditure 2.65 kw-hour, equalling 52.5 watt-hours per thousand pounds per mile for a speed of 14.6 miles per hour.

The total time from the Ferry in Camden to Atlantic City was thus six hours, four minutes and the total distance traveled 68.57 miles. The total expenditure of energy was 9.17 kw-hours. The ampere hour efficiency of the battery may be safely taken as 85 per cent. The charging voltage averaged 110. The total kilowatt-hours necessary to purchase, therefore, to make this run was 12.3, which at 6 cents per kilowatt-hours, the price paid in Atlantic City and Philadelphia, amounts to 73.8 cents, or 1.18 cents per mile.

On the next day, Nov. 16, with battery and carriage receiving absolutely no attention in the meantime, the mileage was continued by running to and fro over the Speedway between Atlantic City and Chelsea until the total of 96 miles was accomplished. The battery was then recharged, a total of 190 ampere hours being put in, being a slight overcharge.

On the next day, Nov. 17, an officially recorded run was made. Two hours before the start, three bicycle riders were selected by the official timers and each of their bicycles fitted with a new Veeder 28-inch cyclometer. These three riders started from the Hotel Windsor over the course shown on the map and rode until their cyclometers registered exactly 50 miles. This point was marked and the riders stationed themselves there, awaiting the arrival of the automobile. The automobile started from the Windsor Hotel on Illinois Avenue, Atlantic City, precisely at 8:30, the time being officially checked by three official timers. The route taken by the bicycle riders was followed.

The times of arrival at the different points were recorded by the Telephone Company and immediately reported to the official timers at the Windsor Hotel. A sort of mimic Marconi system of transmission was accomplished by the throwing of bulletins written en route to the different telephone operators as the automobile passed. These bulletins were in the possession of the official timers at Atlantic City in from two to three minutes after the automobile passed.

Four stops were made between Atlantic City and Pleasantville, owing to frightened horses. Once gaining the mainland, however, where the traffic was less, this trouble was avoided and no stop was made until the arrival at the 50-mile mark which occurred at 11:49. The official checkers were found stationed here and their affidavits obtained as to the time of arrival, the distance from the start and time of departure. The photograph of the 50-mile mark and the three checkers is shown.

The return 50 miles was started at precisely 12 noon. The intervening 11 minutes between arrival and departure being consumed in hurriedly eating a small lunch and endeavoring to build up a little blood circulation on the part of the passengers.

The finish was accomplished at precisely 4:15 before the same gentlemen who officiated as starters.

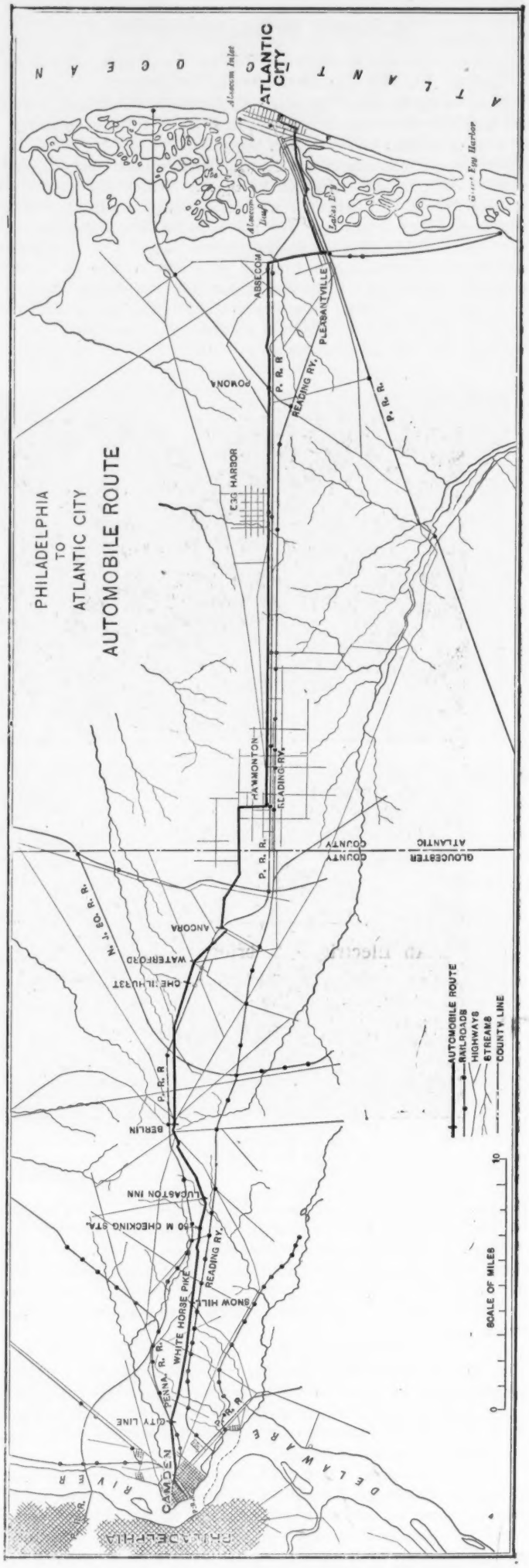
The condensed data for the 100 miles is as follows:

Total distance traveled	100 miles.
Total time consumed	7 hours, 45 min.
Average speed in miles per hour, total time	12.9
Voltage just before finishing 100th-mile	78 at 22 amp.
Total kilowatt-hours expended	13.6
Total kilowatt-hours of charge	20.9
Cost of charge at six cents per kilowatt-hour	$1.25
Cost per mile	1¼c.

The best previous record for an electric automobile on one charge of the storage battery was 136 kilometers, or 84.4 miles, at an average speed of 11.6 miles per hour. The weight of the battery was 2000 pounds.

It will be seen that this record has been materially bettered both in point of distance, speed and output per pound.

On the next day, the batteries having been recharged and a shunt put across the motor fields, the return to Philadelphia was made.



The start occurred at 11 o'clock before one official timer. The first five miles being again across the narrow and poor meadow road leading to the mainland and the traffic and a drawbridge again interfering, anything over half speed was impractical. After getting on dry land, however, improvement was possible at once and the shunt was thrown in by a small hand switch which acted as an accelerator. The time consumed in the first five miles was 22 minutes and 30 seconds.

At Absecom another delay was occasioned by a gravel train stopping to unload gravel directly across the highway. Twelve minutes were lost here in waiting. Once over this railroad crossing, however, no further stop was made for some 35 miles. The speeds taken are as follows:

	Minutes.	Seconds.
First 5 miles (Meadow road)	22	20
Second 5 miles (railroad crossing)	29	10
Third 5 miles	15	42
Fourth 5 miles	15	52
Fifth 5 miles	14	49
Sixth 5 miles (through Hammonton)	18	40

Some four miles beyond Hammonton delay again was met in the shape of a collision with a horse and buggy proceeding in the same direction ahead of us, and which after turning out to let us pass, quickly turned in again with results which may be imagined. A long delay ensued in straightening the matter out and in finding a place where the damaged buggy could be left and in taking the owner home, which was done on the automobile. This required a run of six miles in the direction we were going with three on board.

After this experience, it was thought better not to attempt full speed. Traffic on the road increased steadily until Gloucester was reached, the last six miles being over extremely bad roads and in quite thick traffic. The arrival at Gloucester Ferry occurred at 3:26:35. The total time thus, including all stops, and from start to finish was 4 hours, 26 minutes, 35 seconds, and the total distance 60.7 miles. Thus the average speed, including stops was 13.6 miles per hour. With the stops due to the collision, the railroad crossing, the drawbridge and the delays occasioned in the first five miles and the last six miles by the traffic, the speed in the intervening 49.7, or practically 50 miles, averaged very close to 20 miles per hour.

Consideration must also be given to the season of the year at which this run was taken and the repairs in progress on the roads. The last three miles approaching Egg Harbor City was a succession of loose stones where the road was being repaired.

The voltage of the batteries at the arrival at Gloucester Ferry at the end of this run was 90 at a discharge rate of 20 amperes.

An Electric Drawbridge at Boston.

BY W. S. KEY.

THERE has just been completed and opened for traffic a handsome new bridge across the Charles River, connecting Boston and the historic town of Charlestown, the scene of the famous "Battle of Bunker Hill," which is an outlying but very populous section of the City of Boston. The new bridge has taken the place of the old historic wooden structure erected in 1785-6, which was the first bridge built over a navigable river in this country.

The new bridge is quite up to date in every detail, and, as was to be expected, electricity, compressed air and hydraulic power have all been impressed into service for operating the immense draw.

Over three years ago a new bridge was determined upon and work began, the location being a few hundred feet east of the Fitchburg Depot, just below Haymarket Square. In contemplating this new structure several importants points had to be taken into account. One was the immense amount of shipping traffic passing from the harbor up the Charles River. Something had to be done to facilitate its movements, either by obviating the necessity for opening the draw every time a ship or boat had to pass, which meant the impedance of pedestrian, vehicular and street car traffic over the bridge, or else by the erection of a bridge of sufficient height that there need be no draw at all, so all ships could sail under without difficulty.

As such a structure, owing to the contiguity of a large population and many manufacturing works on both banks of the river, was out of the question, a plan was decided upon that would enable the bulk of the water traffic to pass under the bridge, while the draw would require to be opened only for the passage of large craft. Necessarily the approaches to such a bridge had to be extended long distances into the city from either bank of the river, to avoid too steep grades for every kind of traffic, the approach on the Charlestown side having to cross over and above a steam freight railroad track which for many years had been a constant source of danger, owing to its crossing the busy street leading to the old bridge being a "level crossing."

The designing of the new bridge was placed in the hands of Mr. William Jackson, city engineer, and his assistant, Mr. John E. Cheney. The license of the Harbor and Land Commission was issued Nov. 27, 1895, and that of the Secretary of War Dec. 27 of the same year. On the 20th of July, 1896, after all plans and specifications had been prepared, the contract for the construction of eight piers was awarded and the actual work begun on Aug. 15, 1896.

The total length of the bridge, now it is completed, together with the approaches, is 1920 feet, of which 1090 feet is over the water. It is a steel bridge on stone piers. There are ten spans in all, the ends of the draw forming two of them, having the foundations for the draw in the centre of the two spans. These foundations alone consist of no less than 75,000 barrels of concrete, besides the stonework laid on that mass of submerged material.

The width of the bridge is 100 feet, which is divided into two sidewalks, each 10 feet wide; two roadways, each 29 feet wide, and a central space for street car tracks, 22 feet wide. Over this space, as will be seen by reference to the accompanying cut, provision is also made for two other street car tracks, this being part of the elevated railway system that is now being rushed in its construction in various parts of the city. Thus there are four car tracks, two below and two above, occupying the surface space of only two. The fixed spans are 85 feet each, and the draw span 240 feet, the draw resting on a central pier, on each side of which is a passage for vessels 50

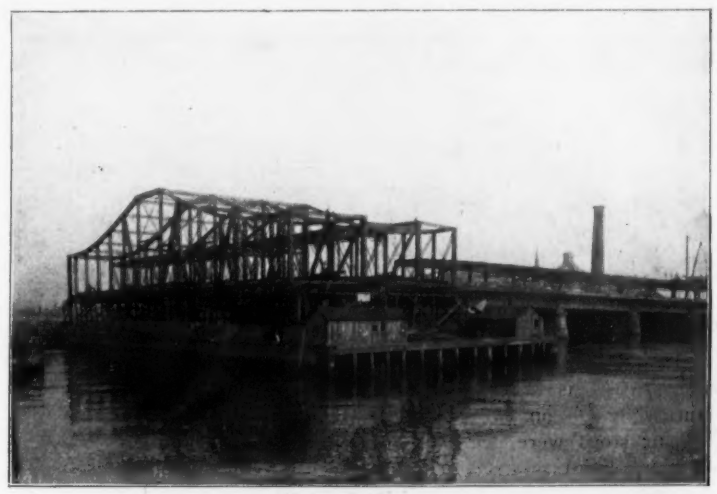


FIG. 1.—ELECTRIC DRAWBRIDGE.

feet wide. The height of the under side of the draw above mean high water is 23 feet. The draw itself weighs 1200 tons, and rests on seventy solid steel wheels 26 inches in diameter, weighing 1400 pounds each, and running on a circular track having a diameter of 54 feet. The entire apparatus for moving the draw is located in a spacious room beneath the centre and in the middle of the circular railway alluded to above.

Owing to the length of the draw and the immense weight of the structure, provision had to be made for distributing and equalizing the weight so that it should not always be wholly on the centre, and thereby create a liability to sag at the ends. This has been accomplished by installing eight hydraulic rams—four at each end of the draw, about 33 feet apart, on which the ends of the draw rest when closed. The rams on the extreme outer edge of the draw are capable of carrying 100 tons each, those nearer the centre being of 200 tons capacity each—1200 tons in all. When the draw is closed the ends are raised 3½ inches, to enable the attendants on the roadway above to insert a series of steel wedges by means of a lever, which hold the draw securely in place; then the ends are lowered one-half inch and there rest upon the hydraulic rams, thus taking off the bulk of the weight from the centre. This setting of the draw in its place is done with the greatest precision and promptitude, the two attendants touching an electric button at each end of the draw which signals the man operating the power, the instant the wedges are in place, whereupon he moves a switch and the ends drop into position.

The hydraulic plant consists of two three-plunger pumps of the

well-known type made by the Stillwell-Bierce & Smith-Vaile Company, Dayton, Ohio. These are operated by two G. E. 10-hp shunt-wound 100-volt motors. To secure the initial pressure for the hydraulic machinery, an air compressor is used, this being operated by a 10-hp motor, made by the Thresher Electric Company, of Dayton, Ohio; the air compressor, which works at 600 pounds pressure, being of the Smith-Vaile type.

The draw is opened and closed by means of two standard G. E. "58" railway motors of 28-hp capacity each. They are installed outside the power house, one on each side and above the circular track with which they are connected by bevel gears and vertical shafts, so as to equalize the moving power.

The black marble switchboard installed in the power house is equipped with four magnetic blow-out switches of the G. E. type, four Weston ammeters and one Weston voltmeter. By means of three G. E. series-parallel controllers the operator manipulates the entire plant. Electricity is also used in setting the ends of the draw during the night; for placed at each end of the under side of the draw, at the centre, is an oblong piece of red glass about 2 feet long and 10 inches wide. This corresponds exactly in size and shape with a piece of white glass affixed in the same relative position on the stationary ends of the bridge, all being in full view of the operator as he stands on a small platform in the power house with his hands on the controllers. By means of clusters of incandescent lamps, current for which is turned on when the draw is to be operated, the glasses are illuminated, and the moment the red glass gets into place in front of the white glass, and so hides the latter from the operator, like a total eclipse, he switches off the current from the motors, and the draw is set.

The power house is well lighted and heated by electricity, as is

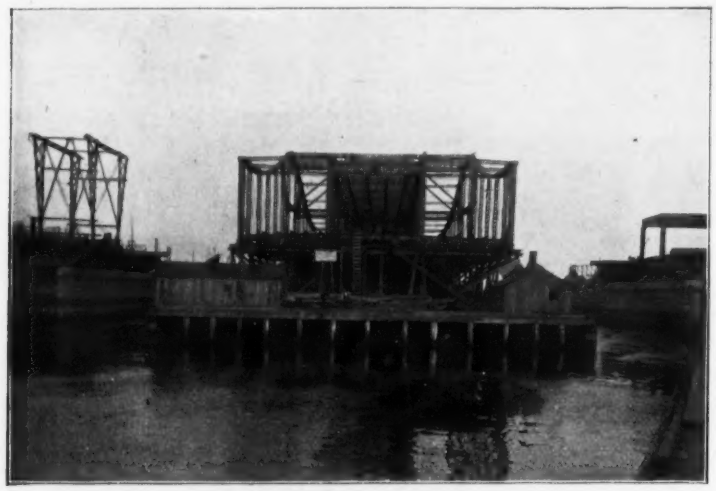


FIG. 2.—ELECTRIC DRAWBRIDGE.

also the big wooden pier under the draw; while the roadway, the full length of the bridge, is brilliant at night with innumerable arc lamps.

Another noteworthy feature is the following: Switchmen are employed by the Boston Elevated Railway Company at the extreme ends of the approaches to the bridge, both on the Boston and Charlestown sides of the river, several hundred yards from the draw, to operate the switches for the cars. Whenever the draw is about to be opened, the operator under the draw in the power house sends an electric signal to each of the switchmen to notify him that the draw is about to be opened in a few minutes. Each man immediately switches all the cars that should go over the pridge in other directions, so they can cross the river at the bridge higher up the river. Thus the traffic is never obstructed by the opening and closing of the draw; it is simply diverted in another direction. A second signal is sent as soon as the draw is closed, and traffic is resumed over the bridge.

The grade of the approaches to the bridge nowhere exceeds more than 3 per cent. The entire cost of the bridge will be very nearly $1,500,000. The A. & P. Roberts Company furnished the steel for eight spans of the superstructure and put it in place; the Pennsylvania Steel Company furnished and erected the two remaining spans and the draw, and Messrs. Miller & Shaw, engineers, of Cambridgeport, made all the machinery and installed it, including the shafting, gears, railway track, wheels and hydraulic rams for moving and setting the draw.

The bridge was formally opened on Monday, Dec. 4, and the average number of times the draw has been opened every twenty-four hours has been twelve. The electric current for lighting and power on the draw is taken from a cable laid under the bed of the river. The bridge is a great success in every respect, and is now one of the sights of Boston.

Alternating Current Diagrams.

BY ROBERT A. PHILIP.

The following system of diagrams is intended to represent graphically the relations between the various elements of an alternating current circuit:

The circuits considered are those which have all their constants (resistance, inductance, capacity) independent of the currents circulating, and which have only a finite number of current paths, that is, no leakage. These circuits are furthermore supposed to be excited by sinusoidal electromotive forces, and, consequently, all currents and differences of potential are also sinusoidal.

I.—THE CIRCUIT DIAGRAM.

In the first place, the actual circuit will be represented by a conventional diagram called the *circuit diagram,* which differs from a conventional picture of the circuit in that the latter endeavors to show the mechanical relations of the parts of the circuit to each other and to other related objects, while the former is concerned with the electrical connections only. The essential features of this diagram are that it shall show every *junction point* (point where three or more currents meet), and every *branch* (that part of the circuit extending between two adjacent junction points) of the circuit. It is desirable that this representation shall be done in the simplest manner possible, avoiding bends, crosses, loops and knots.

A *simple circuit diagram* is one in which each branch is represented by an unbroken straight line. In such a diagram branches in multiple would be represented by coincident lines, but for the sake of clearness of delineation these lines may be spread out so as to show spaces between them.

The system of notation for the parts of a circuit diagram that will be used herein is as follows: Junction points are designated by capitals, branches by small letters, and meshes by Greek letters. This notation is exemplified in Fig. 7.

Convertible circuit diagrams are those which have the same number of junction points of the same kind and connected in the same way. They may be used interchangeably. The number of branches is necessarily the same, but the meshes are different. Fig. 1 and Fig. 2 are two convertible diagrams. Fig. 3 and Fig. 4 are not convertible, the number and kind of junction points is the same, but they are connected in a different way. Fig. 5 and Fig. 6 are not convertible, the number of junction points is the same, but the kind is different.

A *false junction point* is a cross such as occurs in Fig. 2 or Fig. 4; it separates each of the two branches which cross into two partial branches. False as well as true junction points will be designated by capital letters, and the partial branches formed will be designated by the small letter pertaining to the whole branch, but with subscripts attached to distinguish them from one another and from the branch as a whole.

In determining the convertibility of circuit diagrams, only the true junction points need be considered. In general it is desirable to eliminate these false points where possible. That of Fig. 2 may be eliminated by conversion to Fig. 1; it is only an *accidental* false point. That of Fig. 4 may be shifted from one branch to another, but cannot be eliminated by conversion; it is a *necessary* false point.

Circuit diagrams may often be represented more simply by lines in space than by a plane diagram. For example, the six edges of a regular tetrahedron may represent the branches of a circuit, the four vertices representing the junction points. The projection of these edges on a plane parallel to one of the faces gives Fig. 1, while the projection on a plane parallel to two edges gives Fig. 2. The fact that these two diagrams are merely different projections of the same diagram in space immediately establishes their convertibility.

It should be especially noted that the lengths of the various branches and the angles between them have no significance whatever, the circuit diagram is therefore essentially non-vector in character.

II.—THE POTENTIAL DIAGRAM.

Difference of potential has only two qualities, amplitude and phase, and these may be geometrically represented by a length and an angular direction respectively. In order that this representation may be

definite in a given diagram, it is necessary to assume some length as a unit of potential measurement, and some direction as a basis of phase angle measurement. Absolute potential is the difference of potential between a given point and the zero point. Therefore, when any one point of a diagram is assumed to represent a given absolute potential each other point will also represent a definite absolute potential.

In constructing a potential diagram for a circuit from the circuit diagram the above three assumptions may be made as follows:

1. Assume that the potential of some junction point (say A, Fig. 7) is represented by a point A' of the diagram (Fig. 8).

2. Assume that the phase of the difference of potential in some branch radiating from A (say a) is represented by the direction of a line of a' through A'.

3. Assume that the amplitude of the difference of potential in the branch a is equal to the length of the line a'.

The potential of each junction point now corresponds to a definite point of the diagram, and it is only necessary to mark these points in order to represent the junction point potentials; these points may be styled junction points of the potential diagram. Since false junction points have no absolute potential, they will not appear on this diagram. A straight line joining two points represents the difference of potential between the two corresponding junction points, and this is true whether there is, or is not, a branch joining the two junction points. If, however, the diagram is completed by joining only such points as are connected in the circuit by branches, a diagram will be formed which will be called the *potential* diagram of the circuit. Branches in multiple will be represented by coincident lines which may be spread out for convenience, as in the case of simple circuit diagrams.

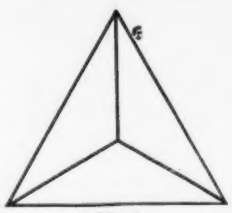


FIG. 1.

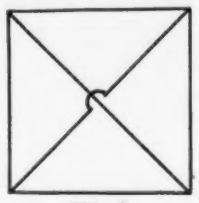


FIG. 2.

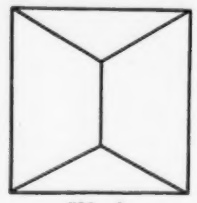


FIG. 3.

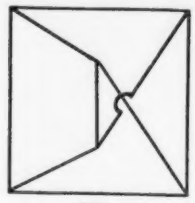


FIG. 4.

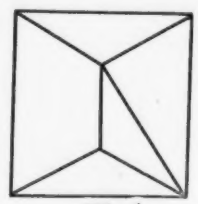


FIG. 5.

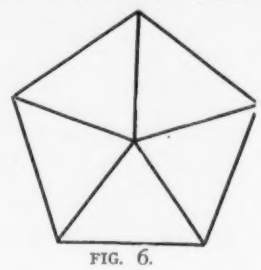


FIG. 6.

Since the representation of each true junction point is absolutely fixed by the three assumptions made above, and since false junction points are not represented, there is only one potential diagram for all converted forms of the circuit diagram.

Comparing the potential diagram with the circuit diagram:

1. Junction points correspond to junction points. 2. Connecting lines correspond to branches. 3. Meshes correspond to meshes. The first two relations hold absolutely for true junction points, and complete branches. The meshes of the potential diagram are arranged in a fixed manner, while those of the circuit diagram undergo changes when the diagram is converted. But every circuit diagram may be so converted that its meshes will correspond to those of its potential diagram, this being the interpretation that should be placed on the third relation given above. The potential diagram is indeed, therefore, in so far as it consists of an arrangement of junction points, branches and meshes, only a special case of the simple circuit diagram. From this it appears that necessary false junction points must be shown, and that accidental ones may be shown.

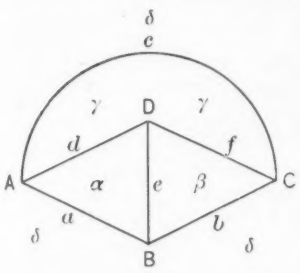


FIG. 7.

The parts of the potential diagram should be designated to correspond with similar parts of the circuit diagram.

Electromotive Forces.—The diagram as now completed shows potentials and differences of potentials but no electromotive forces, although the latter are quantities of a kind similar to, and measured in the same units as, differences of potential. If in any branch the impedance loss is added (as a vector) to the difference of potential the result is the electromotive force in that branch. An auxiliary geometrical construction added to a branch of the diagram will thus show the electromotive force and impedance loss. In Fig. 8 this construction is added to branch c'.

III.—THE CURRENT DIAGRAMS.

Current, like difference of potential, has only two qualities, amplitude and phase, and similarly these may be geometrically represented by a length and an angular direction respectively. In order that this representation may be definite in a given diagram, it is necessary to assume some length as a unit of current amplitude and some direction as a basis from which phase angle shall be measured.

These two correspondences do not establish any relation by means of which currents may be represented on the potential diagram, but they allow of the representation of the amplitudes and phases (though not the mutual relations) of currents on a separate diagram. A current diagram must, however, show the mutual relations of the currents considered as a system.

In constructing a current diagram three assumptions (including the two above) may be made as follows:

1. Assume that some mesh (say a' Fig. 8) of the potential diagram corresponds to some point a' of the current diagram (Fig. 9).

2. Assume that the phase of the current in some branch bounding the mesh a' (say a') is represented by the direction of the line a'' through the point a''

3. Assume that the current amplitude in the branch a' is equal to the length of the line a''.

Each mesh of the potential diagram now corresponds to a definite point of the current diagram, and it is now necessary to find these points. From the point a'' construct all the currents which bound the mesh a'. The point at the outer extremity of each of these current vectors represents the mesh of the potential diagram which the corresponding branch separates from the mesh a'. Proceeding similarly, the diagram is completed when all the currents have been represented. Currents in multiple will be represented in the current diagram by a broken line, the resultant of the currents being represented by a straight line joining the two extremities.

Comparing the current diagram with the potential diagram:

1. Junction points correspond to meshes. 2. Currents correspond to connecting lines. 3. Meshes correspond to junction points.

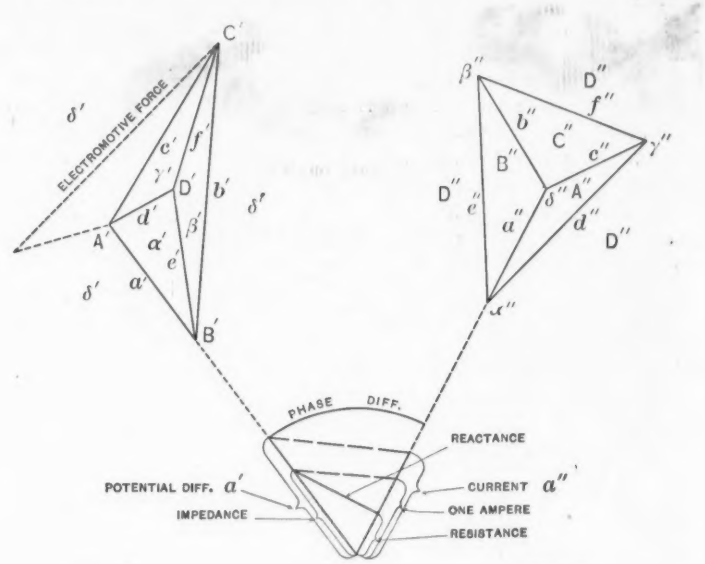


FIG. 8. FIG. 10. FIG. 9.

The parts of the current diagram should be designated so as to correspond to related parts of the potential diagram.

A natural angular relation may be established between these two vector diagrams by measuring phase angle from the same base line direction. An artificial dimensional relation may be established by taking the same unit of length for a unit of current as for a unit of potential difference for example, an inch per ampere in the current diagram and an inch per volt in the potential diagram. There can be no positional relation between them, because points of one diagram represent meshes of the other, therefore, the two cannot be

superimposed except arbitrarily, but for convenience they may be supposed to be constructed (with the above angular and scalar relations) in adjacent, but otherwise unconnected, positions.

Two corresponding lines now being produced through their point of intersection, the least angle between them is the angle of lag (or advance) of the current in the branch behind (or before) the potential difference which produces it. If there is an electromotive force in the branch the line which is to be understood as corresponding to the line of the current diagram is the line of the auxiliary construction representing impedance loss and not the line representing potential difference.

Circuit Constants.—On the two lines which have been produced the current and difference of potential vectors are laid off from the point of intersection. A line equally distant from the outer ends of these two vectors and cutting the current vector at one unit (ampere) distance from the intersection cuts the potential vector at a distance from the intersection equal to the impedance of the branch. The projection of the impedance on the current vector is the resistance, the projection at right angles to the current vector the reactance of the branch. Units of current, potential difference, resistance, reactance and impedance are here all represented by the same linear unit. One such construction for each branch is necessary for the complete determination of the circuit constants. In Fig. 10 this construction is shown for branch *a*.

Reciprocal Relations.—If there be two branches, the impedance of the second being the vector reciprocal of the impedance of the first, and the potential vector of the second being identical with the current vector of the first, then the current vector of the second will be identical with the potential vector of the first. This is strictly true where there are no electromotive forces involved, but in branches where there are electromotive forces it will still be true, provided a certain more complex but less rigid relation exists. Since the current and potential diagrams correspond, branch to branch and mesh to point, the reciprocal relation may be extended from the single branch to the whole diagram as follows:

Two diagrams which correspond to potential and current diagrams respectively of a given circuit, of which the first is a special circuit diagram, also correspond to current and potential diagrams respectively of another circuit of which the second is a special circuit diagram; the impedance of each branch of the second circuit being the vector reciprocal of the impedance of the corresponding branch of the first, when neither branch contains an electromotive force.

Electro-Mechanical Analogies.—Any two rectilinear diagrams which correspond line to line and point to mesh evidently are a pair of potential current diagrams to one or more circuits. Therefore, any pair of diagrams which represent truss and stress diagrams respectively of a framed structure also represent potential and current diagrams respectively, or reciprocally. Comparison shows that the length of a truss member corresponds to the difference of potential between two junction points and the stress in the member corresponds to the current in the branch, or reciprocally, length of member corresponds to current, and stress corresponds to difference of potential.

Any pair of truss-stress diagrams corresponds to a pair of potential-current diagrams, but not conversely. Since the stress in a member of a framed structure is in the direction of the member transmitting it, a pair of potential-current diagrams will only correspond to a pair of truss-stress diagrams when the current in each branch is in phase with the difference of potential. That this may be true the reactance must be zero in each branch not containing an electromotive force, and in the others the component of electromotive force in quadrature with the difference of potential must be exactly equal to the reactance loss of the branch. The relation between the two electric diagrams is therefore of greater generality than that between the truss-stress diagrams. The reciprocal relation of the former also holds for the latter.

In alternating current circuits which do not violate the restrictions just noted, the graphical methods of finding the stresses in framed structures may be applied to the derivation of the current diagram from the potential diagram.

Converted Current Diagrams.—The current diagram has been derived from the potential diagram without however involving the vector characteristics of the latter which distinguish it from a special case of the circuit diagram. Therefore, comparing the current and circuit diagrams: 1. Junction points correspond to meshes. 2. Currents correspond to branches. 3. Meshes correspond to junction points. As long as the current diagram is derived from the potential diagram, the first and third of these relations is true only with regard to a particular form of the circuit diagram. The method of derivation, however, admits of a current diagram being produced directly from a circuit diagram. By the mode of generation a different current diagram is produced by each converted form of the circuit diagram (including those which are not simple), and the three relations above given hold absolutely for corresponding pairs of diagrams. All the different current diagrams give identical values for current amplitude and phase, and identical auxiliary constructions for angle of lag, resistance, reactance and impedance, and all illustrate different applications of Kirchoff's law that the sum of the currents that meet at any point is zero. False points introduced by conversion of the circuit diagram enter the current diagram as parallelogram meshes, the two pairs of opposite sides of which represent the two pairs of partial branches caused by the false point. The meshes representing different junction points may overlap. Fig. 11 shows a circuit-potential diagram, of which Fig. 12 is the current diagram. Fig. 11, when converted to Fig. 13, gives the current diagram Fig. 14.

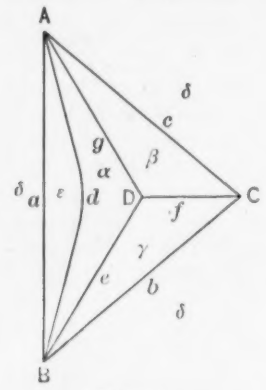


FIG. 11.

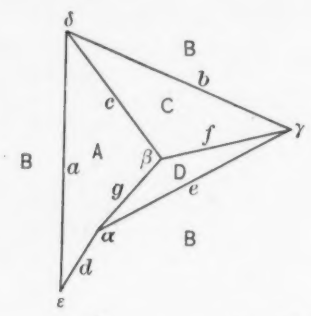


FIG. 12.

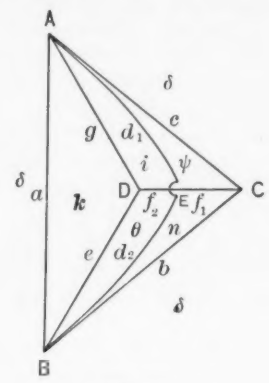


FIG. 13.

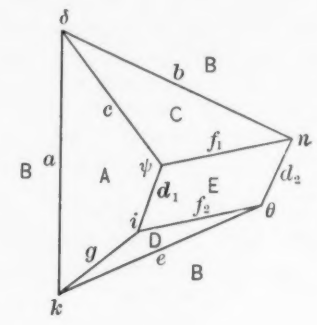


FIG. 14.

The three, or virtually two, correlated diagrams, representing circuit-potential and current, show directly the electrical connections of the circuit, the absolute potential of each junction point, the difference of potential and current in each branch, and show by auxiliary construction the electromotive force, angle of lag, resistance, reactance and impedance of each branch, and give by conversion all the other pairs of circuit and current diagrams.

Electrical Engineering Laboratory Work.

In a paper read by Frank W. Springer, instructor in electrical engineering, University of Minnesota, the methods of laboratory teaching at that university are described with reference to direct-current work. Referring to the character of the instruction at the University of Minnesota, Mr. Springer says that its aim is not to teach trades, but rather to turn out men who are well grounded in theory. Practice can best be obtained outside of college, while theory cannot be taught anywhere else to better advantage than in school. Sufficient laboratory work is given, therefore, to fix the theory, working on the idea that from an engineer's standpoint, what one does not know how to apply he does not know at all. The course referred to provides for 300 hours of electrical laboratory instruction. The paper gives in detail the distribution of this time, which is so systematically apportioned and so well occupied that those in charge of the course have no hesitation in recommending many of their electrical students to take charge of electric power houses and similar work immediately upon graduation.

Lighting the Trolley Bridge at Niagara.

BY ORRIN E. DUNLAP.

The lighting of the new great steel arch of the International Traction Company at Niagara Falls by electricity has resulted in giving to Niagara Falls one of the prettiest night views in that locality. For many years thousands have feasted their eyes on the beauty of the great cataract, but when night came there was little to do. The advent of the popular trolley added to the day delights, and now the use of electricity on the arch has added to the nocturnal pleasures, for the glow of the incandescent lamps in their regular order. stretching across the gorge from bank to bank, leads many to walk out from their hotels to view the sight. Of course, some interest is

FIG. 1.—THE TROLLEY BRIDGE BY DAY.

also attached to it because this is the greatest all-metal arch in the world.

The current for lighting the arch is supplied from the municipal lighting plant of Niagara Falls, Ont. The primary voltage is 2200 and the secondary is 110. Beneath the bridge flooring at the Canadian end there has been installed a 15-kw transformer. Each side of the structure is on a separate circuit, and every lamp is on a separate branch fuse block. In all there are sixty 50-cp incandescent lamps on the bridge. These lamps are furnished by the Sawyer-Man Electric Company, and are of the anchored filament variety, it being found that this style of lamp withstands the vibration with remarkable success. Each lamp is attached to a 1½-inch goose neck and

Copyright, O. E. Dunlap.

FIG. 2.—THE TROLLEY BRIDGE BY NIGHT.

is protected by a Chapin hood. The goose necks are firmly fastened in a special attachment to the bridge railing and are lined with flexible conduit. Vaporproof globes are not used, as it was found that by coating the base of the lamps with hot asphaltum, the plaster of paris was prevented from absorbing the moisture, of which there is an excess, on account of the dense spray from the falls blowing down the gorge and sweeping across the structure very often. The wiring of the bridge was done by Gent Brothers, of Niagara Falls.

The Grand Rapids, Mich., Municipal Central Station.

BY EDWARD JAMES HART.

It is three years ago that the subject of municipal lighting was first agitated in Grand Rapids, Mich., and a year ago last spring the common council passed a resolution to bond the city for a lighting plant, and for more than a year past the work has been progressing upon the plant itself. The building and outside construction work are now completed, the machinery and appointments of the plant are all in place and ready for use, the official tests have been made and it is promised that within a few days, when the lamps have been tested and placed, the city will be lighted with current from its own plant.

The building is far more handsome than those ordinarily erected for the purpose of manufacturing electricity It is erected upon what is known as "The Island"—although it is some years since it was an island—in Grand River. Upon this same "Island" are located the city market and the garbage crematory. It is a place that is not utilized at all for business purposes, save for those that attach to the city market, and an advantage lies in the fact that while the lighting plant building is centrally located and convenient to the business district and railroads, it is sufficiently isolated from the vast major portion of the city so that any noises cannot disturb the rest of sleeping citizens.

The building consists mainly of a large power room, a spacious boiler room, the basement, which is devoted solely to the uses of a condenser pit, and the front portion, which is built with two floors and contains the main entrance. Besides the entrance hall, this last portion of the building is occupied on the lower floor with a large store room for oils and supplies. On the upper floor and just over the main entrance is the testing room, draughting room, two sleeping rooms and a bath room.

The dimensions of the power room, where the engines and generators are located, are 140 by 60 feet, but the floor space represented by these dimensions is much more than the present needs of the plant require, and at a point 88 feet from one end and 56 feet from the other end a tile partition has been erected, dividing the spacious room into two parts. The machinery is located in the larger portion—88 by 60 feet—and the other portion will be reserved until such time as it is found necessary to increase the capacity of the plant. The reserve floor space, both in the power and boiler rooms, makes it possible to double the present maximum capacity of the plant.

The boilers are four in number, of 150-hp each, arranged in two batteries. They are of the modern water tube style of Aultman-Taylor manufacture. An evaporation is claimed of eight pounds of wa-

ter per pound of coal, which means that "Indiana screenings" will be used in the furnaces. Special attention has been given to the arrangements for handling coal, and altogether the boiler room is a model one. In the power room are three 300-hp. engines—4-valve, over air pumps and a compound pump movement. The condenser is located in a pit which is in full view of the power room. This is rather a feature of the building. A whole section of the floor of the power room directly over the condenser machinery is left open, so

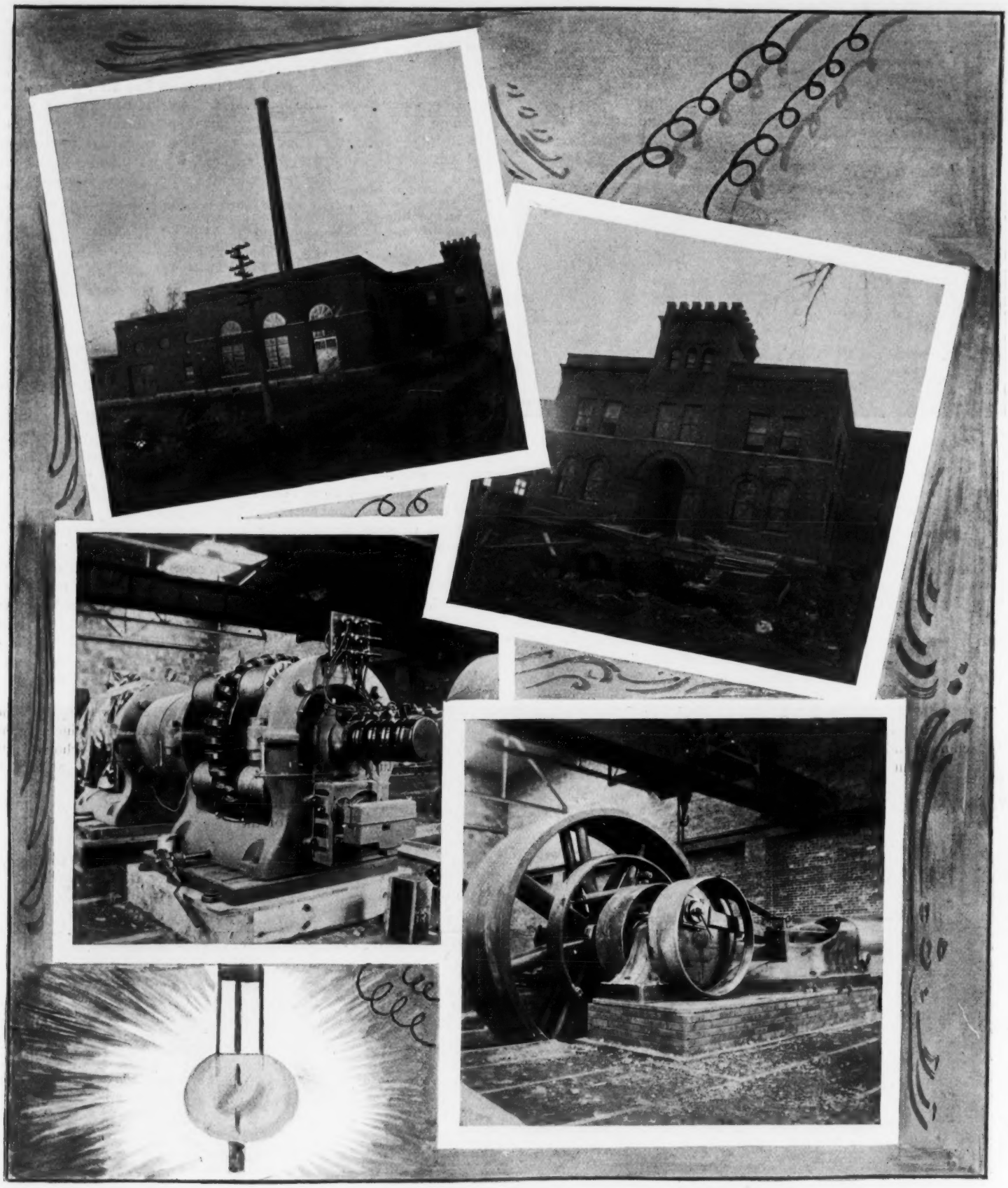


Fig. 1.—Power House.
Fig. 2.—125-Light Brush Two-Circuit Dynamo.
Fig. 3.—Main Entrance to Power House.
Fig. 4.—One of the Engines.

THE GRAND RAPIDS, MICH., MUNICIPAL CENTRAL STATION.

tandem compound, condensing. They are handsome machines, mounted on brick piers finished in red pressed brick with rounded corners. Below the floors a single continuous foundation or pier carries the three engines. The condenser is a Wainwright, with Con- that it is possible to handle this machinery with a steel crane that operates over a permanent runway the length of the power room. This crane has a capacity of six tons. A Green fuel economizer completes the category of steam apparatus, unless mention is made

of the tall smokestack of steel, lined from the base to the top with fire brick.

The generators are six in number, 150 light machines of the Brush type, built by the General Electric Company. Two of these are belted to each of the three engines, the belts running beside each other, and not in tandem. The pulley ends of each pair of dynamos are set together, and the axes of the armature shafts of all six generators are in the same line, as are also the axes of the engine shafts. The dynamos supply a current of 6½ amperes, and each will take care of two circuits of 75 lights. The machines are wholly self-regulating and are equipped with all the latest Brush type improvements. A handsome marble switchboard of an improved plug type, but with no flexible conductors is provided. The board will carry testing and indicating apparatus and safety appliances.

The city for the present will content itself with 475 lights. They are Adams-Bagnall lamps of the enclosed arc pattern, designed for 6.5 amperes and 70 volts. It is claimed that they will give satisfactory service for eighty hours at one trimming, which will make a weekly trimming more than answer the purpose. The outside construction work has been given especial attention, and it is claimed to be as good as anything of the kind in the country. The iron hanger poles of the downtown district, of which there are 35, are handsome affairs, and they will make a very noticeable improvement in the appearance of the streets at night. The city now owns the sixteen 250-foot iron light towers, having purchased them from the company that had the contract for lighting the city, and these, each equipped with four of the new lamps, will be used the same as they have been.

The entire plant complete cost the city $180,000. Before the month is over it will be in operation, and the necessary force of thirteen men to run it will have assumed their duties. This number includes engineers, construction men and trimmers.

The work of installing the boilers, engines, dynamos and electrical apparatus at the city's lighting station, as well as the outside construction work, was done by the Chase Construction Company. Messrs. Nagle & Ball, of Chicago, served the city as consulting engineers. The engines were built by Russell & Co., of Massillon, O., the electrical machinery was made by the General Electric Company, and the traveling crane was supplied by Pawling & Marneschfeger, of Milwaukee.

Exhibits for the Paris Exposition.

What promises to be an interesting and attractive portion of the United States display at the Paris Exposition in its Section of Machinery and Electricity, will be a collective exhibit occupying an area of about 1500 square feet, in which will be shown small mechanical and electrical appliances and devices such as machine tools, instruments of precision, engine and boiler accessories, telephones, meters, switches, lamps, insulating material, house goods, etc.

The government will accept exhibits in this group at its warehouse in New York, assuming entire charge of them from that point until their final return to the exhibitor again, at the same port. In this way the individual exhibitor would be relieved of the annoyance attendant on transportation, customs entry, storage of packing cases, installation, care of exhibits, explanation by competent attendants, judicious distribution of printed matter, etc. Every service and every expense will be covered by a single charge based on case, wall or floor space occupied. This will provide for the "flooring charge" of the French authorities, platforms, cases, counters, tables, hand railings and light posts, wiring, special lighting of cases and exhibits, signs, labels, etc.

An engineer speaking French as well as English (and possibly German), will be secured, and with the aid of one or more assistants will install and care for the exhibits. Being in constant attendance, he can circulate the advertising literature for each firm and be in a position to present advantageously the exhibits to the jury of awards.

An exhibit of this kind will adequately represent each of the firms and be comparatively inexpensive, the entire sum paid in will be expended more efficiently and the trouble and cost to the exhibitor will be reduced to a minimum. The advantages of this arrangement will be extended only to what may be considered desirable exhibits.

There will no doubt be many manufacturers who had not thought of exhibiting in Paris who will avail themselves of such an opportunity.

CURRENT NEWS AND NOTES.

THE NORTHWESTERN ELECTRICAL ASSOCIATION.—The annual meeting of the Northwestern Electrical Association will be held at Milwaukee, Wis., about Jan. 17, 1900.

TROLLEY GIRLS.—There are seven young women conductors on the electric lines at Chillicothe, O., and five at Vincennes, Ind. They work nine hours a day and receive $4 a week.

OLD RAILS.—A street car barn 600 feet long and 206 feet wide is being built in Buffalo of discarded street car rails, it being impossible to obtain steel within the time required. It has a flat roof.

AN INVITATION TO AN EXPLOSION.—The Pike's Peak Power Company has issued an invitation for attendance at the time of an explosion which is intended to break away 40,000 cubic feet of granite at the site of the dam of the company. Thirty thousand pounds of explosives will be ignited at the same moment. The invitation reads as follows: "You are cordially invited to be present at (a probably safe distance of about a mile from) 'Dam Site' on West Beaver Creek, Teller County, Colo., at 2 o'clock p. m., Monday, Dec. 18, 1899, to participate in an explosion of Vesuvius Butte. Kindly bring your kinetoscope and accident policy."

CENTENNIAL ANNIVERSARY OF PROF. HENRY'S BIRTH.—The centennial celebration of the birth of Prof. Joseph Henry was held at Albany, N. Y., on the night of Dec. 16, under the auspices of the Albany Institute and the Albany Historical and Art Society. Mr. Verplanck Colvin, president of the institute, read a letter from President McKinley, attesting to the good work by Prof. Henry in developing magnetic telegraphy. Mr. Colvin, in a tribute to Prof. Henry, said: "In 1831 Prof. Henry developed his system of magnetic telegraphy, and within these halls, Albany Academy, placed a telegraph wire a mile in length, over which signals were sounded by the self-same magnet and bell which you will hear to-night. The telegraph was now a reality; he would not patent it. Thus here began a greater phase of his character—his unselfishness and devotion to the public welfare."

THE POLYTECHNIC INSTITUTE of Brooklyn, is taking steps to fill an even more important part in the educational work of Long Island than it has already done, and is putting itself fully abreast of the highest standing. It has just inaugurated new courses in shop work in connection with the studies in mechanical engineering, the work being patterned after that of the best technical schools in the country, including not merely manual dexterity but the fundamental principles applied in hand and machine tools. The four years' course is most thorough in its gradual development. Prof. Rodney G. Kimball, Ph. D., is in charge of the department of steam engineering; Dr. S. Sheldon, Ph. D., is the well-known professor of electrical engineering, and Mr. F. A. Hannah is instructor in mechanical engineering. The new shops for the students are fitted up with an elaborate equipment of lathes, planers, drilling machines, steam engine, electric motors, etc.

AUTOMATIC TELEPHONE EXCHANGE SYSTEM.—A patent was granted Dec. 12 to Gustave Seligmann-Lui of Paris on a method and apparatus to enable a telephonic communication to be automatically established between the lines of a telephonic system. The patent includes fifteen sheets of drawings containing twenty-nine figures and there are twenty-six pages of text and claims. The subscribers' lines are divided into groups and terminate at the exchange on coupling boards so as to be accessible by electrically-operated coupling devices, there being combined with each group of lines as many such coupling devices as there are groups of lines. The arrangement and operation of these coupling devices are such that any line of any group may be put in telephonic communication with any other line of the same or of any other group. For the purpose of enabling that coupling device to be selected which is in relation to the two groups comprising wires between which it is desired to establish telephonic communication, there is provided for each group of lines a set of operative mechanism and each line is provided with means of making connection with said mechanism. As soon as telephonic communication has been established between any two lines, the said mechanism again becomes available for use, while the connection established remains undisturbed, so that several indepen-

dent telephonic connections may be successively established and concurrently maintained.

PERFORMANCE OF AN ELECTRIC RAILWAY GENERATING PLANT.—In a paper read at the November meeting of the American Institute of Electrical Engineers, Mr. Edward J. Willis gave the results of a test on a 300-kw direct-connected railway generator at different loads. The efficiency or electrical horse-power per engine indicated horse-power was 63 per cent. at a load of 110-kw; 74 per cent. at 160-kw; 79 per cent. at a load of 219-kw, and 79 per cent. at a load of 275-kw. The coal consumed per electrical horse-power-hour was 2.18, 1.94, 1.96 and 2.11 lbs., respectively, at the above loads. The engine is a horizontal tandem compound condensing with double concentric. In making the tests a water rheostat was used consisting of two sheets of boiler plate, 5 feet by 6 feet each. By means of soda the conductivity of the electrolyte was brought to the desired point, and after the water got boiling thoroughly, the load could be maintained perfectly steady. At the load of 275-kw about 15 square feet of each plate was submerged. In using a water rheostat the author advises that if a steady load is required, it is well to let the water come to a boil and the plates remain steady, replacing the water evaporated by a small stream constantly flowing.

EARTH CURRENT TELEGRAPHY.—In a letter to the London *Times,* Prof. Oliver Lodge suggests establishing communication between the British forces and beleaguered South African towns by means of "earth current disturbances." The plan proposed is to have two parallel earth lines, one within the beleaguered town and the other within the British lines. In each line there should be a powerful battery and dynamo and a signaling key; also a commutating switch, a pair of low-resistance telephones, and a condenser "to keep out the earth currents." The method proposed appears to be almost identical with one experimented with by Preece some years ago and which formed the subject of a paper that attracted much attention at the time. In an article in the *American Journal of Science,* of August, 1880, Prof. John Trowbridge referred to experiments involving the same principles. The observatory of Harvard University transmits signals from Cambridge to Boston, a distance of about four miles. Prof. Trowbridge put up an earth line of the kind mentioned by Prof. Lodge, and at points a mile distant from the line joining the observatory to Boston, the time signals transmitted over the line could be heard through a telephone in a grounded trial circuit 600 feet long. Almost fifty years ago Morse successfully experimented with a similar system in transmitting signals between Governors Island and the Battery.

ELECTROLYTIC LAMPS.—Five patents were issued Dec. 12 to Prof. R. A. Fessenden, relating to electrolytic lamps. Two of the patents relate to means for providing a path for electric current along the pencil for the purpose of heating it to a conducting temperature. In one case the pencil is in the form of an arc of a circle supported from two radial arms on the shaft. When the lamp is to be put into operation, this shaft is turned so as to pass between blocks formed of graphite or other conducting material, which are held in such relation to the path of movement of the pencil that the blocks will rub along the sides of the pencil and make a deposit upon it from end to end, a deposit also being made on the exposed edges of the contact plates at each end of the pencil. As the rotation of the shaft continues, electrical contact is made so that a current will pass along the conducting film on the pencil. By the action of this current the pencil will be brought to a sufficiently high heat to render it conducting, the current passing then heating it to a sufficiently high temperature to render it incandescent. The conducting film or path may be formed of material such as graphite which will be burned or destroyed by the heat of the pencil; or, of a material such as manganese peroxide, which is rendered non-conductive at high temperatures. In the second form of lamp a straight cylindrical pencil is used. A screw with its shaft horizontal to that of the pencil causes a block of conducting material to travel in contact with the pencil, the latter being at the same time rotated. By this means a spiral band or a complete coating of graphite will be applied to the pencil and to the edges of the pencil terminals. The passage of the current along this film will heat the pencil sufficiently to render it conducting and as soon as it is raised to a high temperature, the material used to form the conducting path will be destroyed or rendered neutral, so that the entire current will pass through the pencil. Two other patents are on forms of pencils and terminals for electrolytic lamps. As the pencils of this type of lamp must be heated to a high temperature in order to obtain sufficient light, it has heretofore been necessary to form the terminals of material such as platinum, which is indestructible except at excessively high temperatures. The patents describe a composite pencil enabling the use of terminals which need not be oxidizable at high temperatures. The body or central portion of the pencil is formed of material such as thoria, magnesia or kaolin, which, at normal temperatures will not conduct electric currents, but when heated become conductive, the conductivity increasing with increase in temperature. The ends of the pencil, however, are formed of a composition which becomes a conductor at a lower temperature than the other material, consisting of a mixture of thoria and magnesium chloride, or magnesia and magnesium chloride or thoria and magnesia. The end portions of the pencil are so prepared that the quantity of the material which becomes a conductor at lower temperatures shall increase gradually from the point of junction with the body portion, there being an excess of such material at the ends. A mixture of ten per cent., of chloride of magnesium and ninety per cent. of magnesia for the ends is mentioned, the body of the pencil being formed of magnesium. The two patents also describe several forms of terminals for use with the composite pencil. The fifth patent is on a provision for such a regulation of the current flowing as will be necessary to maintain the pencil at the desired point of incandescence. As the pencil in this type of lamp becomes a good conductor when heated, the conductivity increasing with the increase in temperature, it follows that any increase of temperature results in an increased flow of current; the temperature of the pencil will thus be further raised, thereby permitting a still greater current to flow with a corresponding increase in temperature. Consequently a lamp working under such conditions will be extremely wasteful of current and therefore commercially impracticable. In order to prevent any increased flow of current beyond that necessary to maintain the pencil at the desired incandescence, there is placed in series in the lamp circuit a material whose conduetivity will be suddenly and abnormally reduced by the passage of a greater current than that for which such portion of the conductor is proportioned to carry. This material may consist of a lead wire; as soon as the pencil is heated to the desired point a greater flow of current will cause the wire to become softened and present a greatly and suddenly increased resistance. Thus less current will flow through the pencil thereby permitting a cooling down of the pencil. Such cooling down will further increase the resistance in the circuit, thus reducing the current flowing and thereby permitting it to resume practically its normal condition and consequently restore the normal incandescence to the pencil.

LETTERS TO THE EDITORS.

Incidental Uses of Series Field Windings of Compound Dynamos.

To the Editors of Electrical World and Engineer:

Sirs:—I find in your issue of Nov. 25 an editorial upon "Incidental Uses of Series Field Windings of Compound Dynamos," which contains some statements in relation to coupling machines in parallel that I cannot reconcile with my way of reasoning the matter out, and that certainly do not agree with my experience. The statement is made that "The series field of the fresh machine should of course be thrown in parallel with the other series fields * * * before the voltage of the fresh machine is adjusted to equality with the others." Let us see.

Assume two equal machines, *A* and *B, A* running on full load and *B* to be coupled with it. The series field are placed in parallel. This takes half the current from the series field of *A,* and reduces by half the effect of *A's* series field to maintain its e. m. f.; consequently its e. m. f. and the voltage on the whole system drops by ten volts or more, constituting of itself a rather serious disturbance of the regulation. Now, if I understand correctly, the voltage of *B* is adjusted to equality with that of the system, with a half-load current in its series field, but its armature producing no current. Under such a condition how can *B* assume any part of the load? It can only assume its share through an adjustment of its shunt field which raises its voltage and that of the whole system to its original value.

How will it be if the e. m. f. of B is adjusted before its series field is paralleled with *A's? B's* voltage is made equal to that on the

system. Then its circuit and equalizing switches are thrown in together. The current quickly divides between the two series fields, the magnetism of *B's* field increases and that of *A's* field decreases, causing *A's* armature to give up, and *B's* armature to assume half the current, and this without any change in the voltage at the busbars. If the machines are evenly compounded, which all machines to be used in multiple should be, no further adjustment should be needed.

If the machines are over-compounded, say five volts, and *B* is adjusted to equality with the system, while its equalizer switch is open, the effect of closing the circuit and equalizer switches at the same time will be, that the e. m. f. of *B* rises about two and a half volts, while that of *A* falls by the same amount. This does not materially alter the voltage of the system. Its only effect is to cause *B* to take more than its share of the load. The loads may then be equalized by an adjustment of both field rheostats without changing the voltage on the system.

All this is in accord with my experience in coupling compound wound dynamos for the last ten years.

The statement is made that when the fresh machine is adjusted after its series field is parallel with the others, there is no jump in its voltage on coupling it to the circuit. Very true, but I have never found any jump in voltage when the e. m. f. of the fresh machine is adjusted with its equalizer switch open. There may be a jump in the e. m. f. of the fresh machine, but that jump is just what is necessary to enable it to maintain a constant *voltage* at its terminals when its armature assumes its share of the current.

NEW YORK, N. Y. WM. A. ANTHONY.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Standardizing Carbon Brushes.—E. K. SCOTT.—A proposition to standardize them, the suggested sizes for various kinds of brushes being given in three tables. He distinguishes between the graphitized brushes which have been subjected to electric heat, and those baked in kilns in the usual way. One of the two qualities of graphitized carbon has a resistance of 1500 michroms per cb. cm., is quite homogeneous, and keeps the commutators in good condition; it may be used for a current density of 15 amperes per sq. cm. or 97 per sq. in. of surface contact; the second quality is not quite so hard, its resistance is 4500 microhms per cb. cm. and the current density 12 amperes per sq. cm. or 77 per sq. in. of contact surface. For the brushes baked in the ordinary way 8 amperes per sq. cm. or 52 per sq. in. may be used and the resistance is about 6000; a cheaper quality has a resistance of 45 microhms and the densities are 7 and 45 amperes; generally speaking this carbon answers well enough. These are the maximum current densities, about two thirds of which are recommended for the normal; the best of the graphitic carbons can be used with commutators designed for metallic brushes. For the successful use of carbon brushes he recommends the following precautions; the connection between the carbon, holder and rocker must be good, and for large currents flexible cables are absolutely necessary; coppering is advisable when the blocks are merely gripped; the holders should be as light as possible and the pressure about 50 grams per sq. cm. contact surface for the graphitic and 100 for the ordinary carbon, this being equal to 0.7 and 1.44 pounds per sq. in. respectively; the surface of the commutator should be absolutely true.—Lond. *Elec. Rev.*, Nov. 24.

Drop of Voltage in the Armature of Alternators.—BEHREND.—An article discussing the practicability of two different methods for predetermining the drop of voltage in the armature of alternators. The first is the one recommended by Behn-Eschenburg and Kapp, in which the short circuit current is used for the determination of the self-induction of the armature; the second is that recommended by Rothert (Digest, Sept. 30, Oct. 7). The author tested both methods on many machines and gives the data for two of the cases. He concludes that the first method is only approximate, but can be used in practice to advantage, while the second method is very dangerous for designers, as it may give entirely wrong results. Incidentally he refers to the type of alternator used in the famous Lauffen experiments, with its immense stray field, and says that other types which were also used at that time were not at all perfect as to the straying, the poles being close together. He claims that this point has not received due attention by designers, although the distance of the poles is the clue to the construction of good alternators; as an instance, he states that this point has often been entirely neglected by a well-known American manufacturer.—*Elek. Zeit.*, Nov. 30.

Motor Generators and Synchronous Converters.—EBORALL.—A continuation of his article (Digest, Dec. 16) claiming that in the following points synchronous converters are better than motor generators; smaller floor space, greater overload capacity, higher efficiency, higher power factor.—Lond. *Elec. Rev.*, Dec. 1.

LIGHTS AND LIGHTING.

High Voltage Incandescent Lamps.—A long illustrated editorial article on the present state of the art in England, where many of the central stations have doubled their voltage, now using 200 to 250-volt lamps. Illustrations are given of the shapes of the various lamps, together with a number of curves of efficiency, candle-power, etc., of various lamps. The average standard efficiency of the high voltage lamps is about 4 watts per candle, which, however, varies considerably during its life. The lamps of the Zurich Co. use untreated filaments, the standard efficiency of the 16-cp lamps being from 3.5 to 3.7 watts per candle of 8-cp up to 4 watts. The Robertson lamp also uses untreated filaments. The object of treating is not merely to make them regular but to coat them with a surface which has a lower emissivity and therefore better efficiency; flashed lamps as a rule fall off less in candle-power, but there are said to be a greater number of premature failures. Attention is called to the fact that the carbons of the finer filaments are denser and have a lower specific resistance after coming from the baking pots, and it is suggested that an investigation of this might lead to a considerable improvement in unflashed filaments. The output of the high-voltage lamps is increasing daily, 50 per cent. of the lamps of one maker, about two-thirds of another, and 80 per cent. of a third, are for 200 volts and over. The standard efficiency of the Sunbeam lamp is 3.75 watts per candle; of the Berrenberg Co., 2 and 2.5 for 16 and 8-cp lamps respectively for a fairly long life; of another company 3.5 watts per candle. A Seaman's voltage regulator for incandescent lamps is briefly described; an apparatus attached to a voltmeter cuts resistance in and out of the main circuit by means of mercury cups and two vibrators, so that the voltages at the lamps is kept constant. In conclusion a reference is made to the difference between the English standard and the Hefner amylacetate lamp; some English makers use the latter; a 16-cp lamp named according to the Hefner unit, will give only 14 candles according to the English standard; an efficiency of 3.5 watts per Hefner standard represents 4 watts per English standard.—Lond. *Elec.*, Nov. 17 and 24.

Nernst Light.—A reprint of a report of our Consul in Germany. Besides facts which are already well known, he states that the rod is now made from the so-called rare earths, and is three or four inches long, being surrounded by an open glass globe The efficiency claimed is 1.5 watts per candle for large lamps and 1.6 for small ones, or those of low voltage; the spectrum of the light is almost exactly like that of sunlight. One of the difficulties is the lighting, which is accomplished either by means of a spirit lamp or an electrical preheater. The apparatus is said to be so expensive that its introduction will be seriously limited. The best efficiency obtained is said to be two-thirds of a candle per watt, but the life of the rod is then only about 300 hours. It is thought that it will supersede all other forms of artificial light for photography.—*West. Elec.*, Dec. 9.

POWER.

Electric Driving of Rolling Mill Machinery.—LASCHE.—An abstract of a description of the motor installation for driving the rolls for rolling copper wire and rod in the works of the General Electric

Co., of Berlin. The machinery of the plant consists of four sets of heavy rolls and seven fine rolls, the former being driven by a polyphase 200-hp motor making 380 revolutions per minute, connected by rope gearing through sheaves of 4½ and 16½ feet respectively, with the main roll shaft; the fine rolls are driven directly by a 400-hp polyphase motor making 420 revolutions and directly connected, a flywheel being attached to the motor. The behavior of the polyphase motor under sudden fluctuations of load, together with the influence of the flywheel as an equalizer, is discussed. The speed of the main roll shaft falls from 105 to 103 revolutions when the load increases from 80 to 220-hp in 20 seconds, the speed of the fine roll motors falls from 420 to 410 revolutions in 12 seconds when the load increases from 80 to 360-hp.—From *Stahl und Eisen,* abstracted at *Eng. Mag.,* December.

Direct Driving in Machine Shops.—LOZIER.—A short illustrated article referring to the speeds of operating machines, the amount of power necessary, and the effect of the use of electric power on the general arrangements of the shop; a number of electrically driven tools are also illustrated. He refers chiefly to the advantages derived from being able to change the speed of the motor, by which means the most possible may be gotten out of each tool, and this can be accomplished electrically much better than with the usual cone speeds; there are at present in successful use direct connected motors which will run continually at any number of speeds, and they may be made to operate at a constant torque; but how this is accomplished he does not describe. The small amount of power necessary to run an establishment with directly connected motors, he says has been shown to be astonishing; in plants where only the main belting has been replaced with electric motors, the saving in power has been sufficient to light the establishment, and where all shafting is replaced there is a considerable saving in coal.—*Cassier's Mag.,* December.

Jacques-Cartier Water Power Plant.—An illustrated description of the transmission plant at St. Gabriel, Quebec, which is now rapidly approaching completion. A fall of 30 feet in the St. Gabriel River, occurring in rapids 200 yards in length, is used to drive water wheels direct connected to two 750-kw three-phase alternators at 2000 volts and 7200 alternations per minute. Six 250-kw transformers raise the voltage to 20,000 volts three-phase at a frequency of 60 cycles per second. The current is transmitted to Quebec, 18 miles distant, by overhead wires and there transformed down by four 375-kw transformers to the voltage required for the distributing circuits.—*West. Elec.,* Dec. 9.

Water Power.—A short illustrated description of the arc lamp installation in Columbus, Ohio. The capacity of the pumping station of the city's water supply had been found to be greater than necessary, and it was decided to use the surplus of the water that the pumps were capable of supplying to drive water wheels directly connected to dynamos. The difficulty lay in the very limited space available for the machine and piping, and in the high speed of 650 r. p. m. required for direct connection with the 100-light arc dynamo. The construction of the wheels is described.—*Sc. Amer. Sup.,* Dec. 16.

REFERENCES.

Gas Engines.—A note stating that the use of gas engines in public electric lighting plants is not making much headway, while they are being adopted for private work on a somewhat large scale. The installation of the Brunner-Mond Co. with gas engines of 1000-hp each, is cited and the gas driven station in the town of Oerlikon is briefly described.—Lond. *Elec. Rev.,* Dec. 1.

Cheap Fuel.—CROMPTON.—A paper read before the English Institute of Electrical Engineers, on the influence of cheap fuels on the cost of electrical energy. He discusses three classes of cheap fuel available for generating electrical energy and the methods of dealing with them.—Lond. *Elec. Rev., Elec. Eng.,* Dec. 1; *El'ty,* Dec. 6; abstracted in *Lightning,* Nov. 30; also discussed in Lond. *Elec. Rev.,* Dec. 1.

High Voltage Transmission.—GUYE.—The first part of an illustrated article on high voltage power transmission in the United States, discussing transformers, insulators for high tension, and the loss through the air between two high voltage conductors.—*L'Eclairage Elec.,* Nov. 18.

TRACTION.

Electricity for Branch Lines.—DAVIS.—A long discussion of the advantages of electricity over steam for branch lines of steam railroads. He reaches the following conclusions: In his opinion steam railroads will in the near future handle their suburban and short-distance interurban traffic by electric motive power, irrespective of whether the operating expenses are affected favorably or unfavorably; long-distance passenger and freight traffic will be handled by steam. Trunk railroads may under exceptional conditions of large volume and great density of passenger traffic over comparatively short distances, use electricity, but such cases will be infrequent. New railroad lines connecting very large centres of population will be operated electrically, when frequent service at much higher speeds than can be attained now by steam locomotives on existing lines, are conditions of success.—*Proc. Am. Soc. Civ. Eng.,* November; the conclusions were editorially commented upon in these pages.

Mono-Rail Electric Road at Elberfeld.—PETERSON.—An abstract of a recent paper on this road in Germany, an illustrated description of which was published in the preceding issue. He discusses the question of the inclination from the vertical due to various causes; wind pressure was not found to be important; the change of the centre of gravity on account of the location of the live rod was practically negligible; concerning the centrifugal force he gives a table for the inclination at different speeds, showing that a suspended car can take a given curve at a much higher speed and can also take much sharper curves; the design of the curve is important and is discussed graphically. The line is 13.3-km long, of which 10-km is over the Wupper River and the rest in city streets; the cars are 12-m long, carry 50 passengers, and are suspended from two trucks 6-m apart; all the wheels are drivers; the proposed regular speed is 50-km per hour.—*St. R'y Jour., Int. Ed.,* December.

Three-Phase Current Distribution for Railways.—A description, with a map, of an extended system of power distribution for electric traction in Central Indiana. The length of the lines now under construction, will be in all nearly 140 miles. Three-phase current at 400 volts will be generated in the power house in Anderson by three 1000-kw revolving field generators, and raised to 1500 volts by means of fifteen 250-kw transformers for distribution to eight substations at nearly equidistant points. There the current will be stepped down to 380 volts by transformers and changed to direct current at 550 volts by synchronous converters and then distributed to the road in the ordinary way. At each of the substations, and also in the power house, there will be a storage battery in parallel with the rotaries, so as to equalize the load. All of the substations will have differential boosters run in series with the batteries.—*West. Elec.,* Dec. 9.

Overhead Line Construction for Traction.—HERRICK.—In this continuation of his serial he discusses the erection and testing of feeders and the setting up of poles. The tendency now is to use large feeders; tinning is unnecessary except if insulated wires are exposed to salt air or corrosive gases. A number of styles of joints are illustrated, described and discussed, and instructions are given for testing the conductivity and insulation of the trolley line. Wooden poles are usually set 18 per cent. of their length in the ground; their life is considerable increased by treating the butt with creosote; ordinary paint has an opposite effect.—*St. R'y Jour.,* December.

Railway Repair Shop.—STUART.—An illustrated description of the electric power plant in the extended Chicago Great Western Railway shops. There are three 100-kw, 220-volt direct-current generators. In the various shop buildings 31 motors, ranging in size from 2½ to 60-hp, are used for driving the shafting and various other applications. A voltage of 220 is used throughout for all purposes.—*West. Elec.,* Dec. 9.

Automobiles.—HANCHETT.—A series of notes, the first dealing with the life of the positive plates of storage batteries. Most manufacturers of batteries for automobiles figure on their renewal at least once a year, while batteries in central stations have been in use ten or fifteen years without the slightest signs of deterioration, because they are charged and discharged every day at the proper rate, and are never fully discharged nor overcharged. To cut down the repair bills, the automobilist should charge the battery at a low rate for long periods of time whenever possible If some of the electrolyte is spilled, it is a safe rule to replace it with nothing but distilled water; to add new electrolyte, could sometime be very injurious to the battery. The proposition to drive a vehicle by a motor which receives its current from a dynamo propelled by a gas engine, is briefly discussed.—*The Automobile,* December.

Columbia Electric Omnibus.—A short description with illustration of this electric omnibus for 14 passengers, which is soon to be tested

in actual service on Fifth Avenue and other streets of New York. The maximum speed is to be 10 miles per hour, the run 35 miles over country road, and there are three speeds each way. The wheels have cushion tires; the motor develops 4-hp normally or 12-hp maximum. The total weight with batteries is 4500 pounds.—*The Automobile,* December.

REFERENCES.

Electric Traction Statistics in England.—A large folded table in the form of a supplement, giving a list of the electric tramways and railways in England, with many statistical particulars. There are 47 overhead trolley lines in the United Kingdom and one accumulator tramway. The list of electric "railways" comprises 6 lines in London and 7 provinicial lines. No summary is given.—Lond. *Elec. Rev.,* Dec. 1.

Railway Statistics for Austria.—A statistical table of the traffic of the electrical railways of Austria and Bosnia from July to September, '99, and a comparison of the traffic and of the gross receipts in 1898 and '99.—*Zeit. fuer Elek.,* Nov. 26.

Automobile Omnibus.—An illustrated description of the omnibus of Siemens & Halske for running on rails or on the pavement, as noticed in the Digest Aug. 5 and Oct. 14.—Lond. *Elec.,* Dec. 1.

Electric Automobiles.—WILKING.—A very long illustrated description of the electric automobiles at a recent international exhibition of motor-cars in Berlin, which was referred to in the Digest Nov. 18 and Dec. 9.—*Elek. Zeit.,* Nov. 23.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Central Station Practice.—THOMAS.—An article discussing some transmission problems for modern central station supply. It is now generally agreed that it is preferable where possible to concentrate the generating plant in one station and to use large units, and as few as practicable. He discusses some cases where it is profitable to generate direct current for local supply and to use high tension alternating or polyphase currents for transmission to outlying districts, and says that in a number of cases double current generators may be used to advantage. He believes that now, after they have had an extended practical and successful application in Chicago (see the article of Niesz, Digest, Oct. 21) they will be considered more frequently in the future. Such machines, however, have certain limitations, and consequently one should not have all the machines of this kind in one station; for modern direct-current machines the armature reaction is commonly made larger than is consistent with good regulation as alternating-current generators, and such armature reaction sometimes serves a useful purpose; moreover, to obtain a suitable frequency, the number of poles generally exceeds that usual with direct-current machines. In general, comparatively large units, and a low frequency, as 25, are conditions most suited to the use of double-current generators. They may be used as intermediaries in stations where both direct and alternating current plant is installed, and would in such cases take the place of rotary transformers. They will also be used in cases where most of the current is only of one kind, the other being conveniently obtained from double-current generators. A third case, with very attractive features, is that of a comparatively long railway line, on which only one or two trains are running at a time, in which case double-current machines may be installed in the generating station and synchronous converters at suitable positions along the line. When a train is in the neighborhood of the generating station, it takes current almost entirely from the direct-current end of the machine; when it is close to any of the substations, the power is derived from the alternating end of the machine, so that the same generator automatically adapts itself for both systems of distribution, and the plant is of the simplest and most economical character possible.—Lond. *Elec.,* Dec. 1.

Converting Alternating into Continuous Current.—LIEBENOW.—A description of a modification of Graetz's method to convert alternating into continuous current by utilizing the property of cells having one aluminum electrode by which they let only such currents pass for which the aluminum is cathode. (See the abstract of the article by Norden, Digest, Oct. 7.) An arrangement is illustrated in the adjoining Fig. 1, in which *b* and *B* are such batteries, *b* letting the current pass only from the left to the right, *B* only from right to left; *c* and *C* are condensers, *r* a resistance representing the place where the useful work is done; that is, lamps, motors, etc., in which the current will always be in the same direction. The condensers may be replaced by polarization cells or accumulators which are then connected in series, so that instead of two condensers there is one accumulator battery, *a,* Fig. 2, the middle point of which is connected with the one pole of the alternator. From the poles 1 and 2 of the battery continuous current can then be taken for the external circuit *r.* If it is necessary to keep the voltage between 1 and 2 constant, as for lamps, for instance, cells of the batteries can be switched in or out; it is important, however, to switch these cells in or out alternately in the two halves of the battery.—*Elek. Rund.,* Nov. 1.

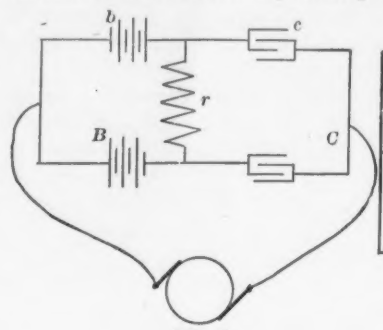


FIG. 1.

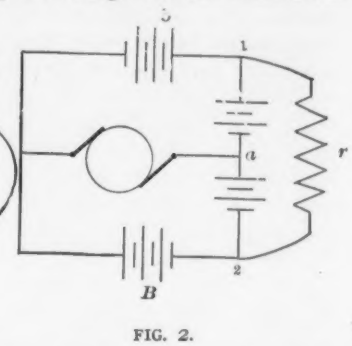


FIG. 2.

High Voltage Switch.—A brief illustrated description of the form devised by Sprecher. It consists of the now well-known Siemens form in which two wires are near to each other at the bottom and become farther apart at their upper ends, and in addition there is a plunger switch immediately below; this is closed, the current is sent through it and it is then opened, the arc immediately jumping to the bent wires and extinguishing itself. It has been tested on a 600-hp two-phase alternator which was loaded inductively, and at 5000 volts it opened the circuits with 105 amperes. The apparatus is to be installed on 10,000 to 20,000 volt circuits.—*Elek. Ans.,* Nov. 26.

REFERENCES.

Burnley.—The first part of a long, illustrated description of this English plant which at present furnishes current for lighting and in the future for traction, and which is to be changed over from 220 to 440 volts between the outers. A three-wire system of distribution, with 220 volts between the outers, was originally used; a two-wire system has been temporarily resorted to. The boilers, engines and the two 250-kw dynamos are described. There is also a three-wire balancing transformer and an accumulator.—Lond. *Elec. Eng.,* Dec. 1.

WIRES, WIRING AND CONDUITS.

Resistance of Iron Wires to Alternating Currents.—MERRITT.—An account of researches by Denio, to investigate the increase of resistance due to the throttling effect which prevents an alternating current from penetrating completely to the centre of the wire and is especially noticeable in iron because of the high permeability. The results are given in two diagrams representing the resistance as a function of the current, and show what was to be expected theoretically. For relatively small currents the iron is only weakly magnetized, so that its permeability is small and the behavior of iron is not very different from that of non-magnetic metals. As the current increases, the resulting magnetization becomes greater, the permeability rapidly increases and the throttling effect will become well marked, the alternating current resistance then being appreciably greater; the increase in resistance is greater for large wires than for small ones. If the current is increased still more, the outer layer of the wire begins to be saturated, and the permeability of this part is diminished, so that the wire may now be considered to be equivalent to a core of high permeability surrounded by a shell of practically non-magnetic material. The thickness of this saturated or non-magnetic layer increases with increasing current until finally the wire is saturated throughout, after which it again behaves like a non-magnetic substance, and the resistance for alternating currents becomes appreciably the same as that for direct currents. An exact quantitative theoretical study is very complicated; by an approximate theoretical treatment, however, he obtains results which are approximately in agreement with the measured values.—*Phys. Rev.,* November, December.

Insulated Cables.—SCHAEFER.—An account of the progress in insulation for electric transmission lines, summing up the experience of a German maker of high class vulcanized india-rubber wires and high tension cables. Some installations are described and the specifications given. He sums up the results as follows: Well constructed cables can be relied upon at a working potential of 11,000 volts. Pieces of well insulated high tension cables can be laid underground and put in circuit with a line or network of overhead insulated conductors without great liability of the cables being damaged by light-

ning; lightning guards at the junction of the underground and overhead lines, are not necessary; this was verified by the experience at Niederloesswitz, a locality visited by exceptionally heavy thunderstorms. He describes the experiments made in the 10,000 volts transmission line between Meran and Bozen, where two cables of 300 yards were laid side by side and worked alternately, one with india-rubber insulation and lead casing over the stranded cores, the other with "kabelit" insulation and lead casing over each separate core. It was found that kabelit insulated cables are as reliable for high tension work as those of india-rubber, and that lead casing over each core in multiple cables for high tension work does not make the cables electrically inferior to cables with lead over the stranded cores. Whether it makes the cables electrically better, can only be proved by comparative results with cables which are otherwise of equal construction.—*India Rubber World,* Dec. 1.

Earthing the Neutral Wire.—Heaphy.—A note pointing out a possible danger due to earthing the neutral of a three-wire system. When the neutral is earthed at the station only and there is a considerable drop of voltage in it, then, when the fault arises in a consumer's wiring, connecting this earthed wire to ground, a considerable part of the return current may be shunted through this fault to earth and it might be easy for this to start a fire. An earth on the other pole would immediately blow the fuse, but in the above mentioned case the fuse would not blow. In some cases no switch is inserted on the earthed neutral and it is therefore possible that the large part of the return current from another consumer may flow through this fault which might be on uninhabited premises. He therefore believes that a double-pole switch should be insisted upon in every consumer's main circuit when one pole is earthed; to guard against the other possibility is more difficult; to earth the neutral at several points in the network would eliminate the fire risk but would be likely to cause electrolytic troubles.—Lond. *Elec. Rev.,* Nov. 24.

Batthurst.—A discussion of the above; he points out that if the concentric system of wiring in which one conductor completely surrounds another, is adopted, and the earthing principle carried out consistently, both in the houses and on the streets, the accident could not have occurred. He takes occasion to call attention to the advantages of the earthed concentric system of wiring.—Lond. *Elec. Rev.,* Dec. 1.

Breakdowns in Cable Networks.—An article pointing out that the most dangerous breakdowns are liable to occur near the central stations where several main cables are laid parallel for short distances; it is proposed to lay reserve cables in those places, which can be used in the case of a breakdown. The arrangement is briefly outlined.—*Elek. Anz.,* Nov. 26.

Design of Fusible Cutouts.—Glover.—A reprint of a Chicago Elec. Assn. paper discussing the question and making some recommendations. Bases are now universally made of porcelain, but there is a difference of opinion as to whether it should be glazed or unglazed; in the former case cracks sometimes occur in the glaze, which gather moisture; he recommends that those parts which are around the fuse should certainly be left unglazed. There should always be a cover including a considerable air space about the middle of the fuse, but the ends should not be left open entirely. He recommends a long fuse. A substitute for a wire consists of a fibre tube filled with a porous powder containing a small air chamber. A fuse of several small wires is much more sensitive than a single large one and a thin flat ribbon more reliable than a round one.—*St. R'y Jour.,* December; *West. Elec.,* Dec. 2.

A paper of a simliar nature by the same author. Besides the above he states that for every fuse there is a critical length which is as follows: 2.5 inches for 3 to 5 amperes, 3.5 inches for 10 to 15 amperes, 4 inches for 20, or for each 5 amperes an increase of a half inch. These lengths are greater than the usual ones. The International Code specifies 1.25 inch for 100 volts or 2.5 for 220.—*Amer. Elec.,* December.

REFERENCES.

Brussels.—Pierard.—An abstract of the French article on the laying of the telephone lines of Brussels underground, noticed in the Digest Dec. 2.—Lond. *Elec.,* Dec. 1.

Telephone Wire Supports on House Tops.—A short illustrated description of some recently designed fixtures.—*El'ty,* Dec. 13.

Safety Fuses.—An illustrated description of a recently patented form of safety fuse for house connections in three-phase current installations.—*Elek. Anz.,* Nov. 19.

Electro-Physics and Magnetism.

Inductance of a Portion of an Electric Circuit.—Allen.—The conclusion of the article noticed in the Digest Dec. 16. After having concluded the theoretical treatment of the case of a main circuit and a voltmeter circuit, he describes a series of experiments in which the voltmeter wires were arranged in three different ways, and gives the results of the measurements in tables. The results are summed up as follows: It is possible for the effect of mutual inductance between the main and voltmeter circuits, to nearly neutralize the effect of the inductance of the main circuit, so that the volts recorded are only a little more than those required to send the current through the resistance. The very worst arrangement of the voltmeter wires in determining the impedance of a portion of a loop, is that in which they are led along the conductor to a meeting point, and are then twisted together from there to the instrument. In some cases mutual induction can be avoided, but more often the impedance of a portion of a looped circuit cannot be determined by means of an alternating-current voltmeter.—Lond. *Elec.,* Dec. 1.

Conductivity of a Mixture.—Lees.—Abstracts of two Physical Society papers. In the first he develops theoretically a new formula for the conductivity for heat or for electricity of a liquid mixture of two or more constituents, present in fixed proportions. If there are two constituents, the percentage in which they are present in the mixture being k and K so that $k + K = 1$, the conductivities being c and C, a former formula gave the conductivity of the mixture equal to $kc + KC$, another former formula gave the resistance of the mixture equal to $k/c + K/C$; in general the first formula gives too high, the second too low values, for the conductivity. His new formula gives the conductivity equal to the product of the two conductivities raised to the power k. In his second paper he shows that this formula gives values for heat conductivities which are in better agreement with experiment. In the discussion it was pointed out that these formulas are of direct application to mixtures of two or more dielectrics both as regards capacity and dielectric resistance.—Lond. *Elec., Elec. Rev., Elec. Eng.,* Dec. 1; discussed in an editorial note of Lond. *Elec. Rev.,* Dec. 1.

Röntgen Rays.—Rollins.—A continuation of his illustrated series. A note on the power of harmonics, points out the importance of massive cathodes; he describes some experiments which he claims prove Röntgen rays to be a "hydrogen phenomenon" in which the particles of hydrogen come rushing out of the cathode, strike against the target, are heated and therefore vibrate, throwing the ether into waves unlike those of ordinary light, on account of the higher pitch and shorter trains quickly diminishing in frequency and amplitude, because the particles are so small that they lose heat rapidly. In a further note on the depth of radiant area he describes an experiment with Röntgen rays passing through a slit, and criticises the theories of Stokes and J. J. Thomson.—*Elec. Rev.,* Dec. 6.

Charge and Mass of Cathode Particles.—Simon.—An account of an experimental determination of the ratio of the charge of a cathode particle to its mass, which value has become important since the discovery of the Zeeman effect. He found this ratio to be 18,650,000 c. g. s. units.—*Wied. Ann.,* No. 11; abstracted in Lond. *Elec.,* Dec. 1.

Radium.—Curie.—An account of an experimental investigation which showed that radium is not allotropic barium and that the atomic weight of radium must be greater than that of barium.—*Comptes Rendus,* No. 13; abstracted in Lond. *Elec.,* Dec. 1.

REFERENCES.

Induction Coil Experiments.—Dailey.—An interesting description of instructive and entertaining phenomena based on the persistence of vision and consisting in rotating discs representing progressive movements of an object like in a well-known form of toy.—*Elec. Rev.,* Dec. 6.

Electrographs.—Gates.—Some illustrations accompanied by a description of pictures obtained by the electrochemical action of the current on the film of a photographic plate.—*El'ty,* Dec. 13.

Electro-Chemistry and Batteries.

Electrodeposition of Zinc.—Cowper-Coles.—A short illustrated description of a series of experiments made to ascertain whether the adhesion of electrodeposited zinc on iron and steel could be increased by depositing it under hydraulic pressure. The apparatus is described and illustrated; three photographic views show the deposits obtained under a pressure of one ton per square inch at current densities of 17, 50 and 100 amp. per square foot; that obtained with 50 amp. was a beautifully smooth, closely grained deposit. The electrolyte contained 35 oz. of crystallized zinc sulphate, one gallon

of water, 1-10 oz. free sulphuric acid, and a small quantity of zinc dust to prevent the solution becoming too acid; the anode was zinc. In an editorial note it is pointed out that it is not easy to see how the use of hydraulic pressure can effect the quality of the zinc deposited, and that a more obvious method of producing a good deposit would be to burnish by mechanical pressure, as in the Elmore copper process, such burnishing being designed to hinder the formation of small prominences which, when once started, tend in the usual process of electrolysis to grow rapidly.—Lond. *Elec.*, Dec. 1.

Electroplated Ships.—A note from a report to the Navy Department showing the record of the American steam tug Assistance, which for four years has been used as an experiment in electroplating the hull with copper as a method of protecting the bottoms of iron ships. The experiment was very successful; although the Assistance had been in water constantly since February, 1895, and no attempt had been made to clean her bottom, it was found to be remarkably clean. In the process the copper is said to be "fused" into the steel plates to a depth of about 1-32 of an inch. The time required to treat a plate is about 48 hours. The cost of the process is said to be $3 per square foot. The plates can be coated before they are fitted in place. The new warships now being built may be protected in this way.—*Jour. Frank. Inst.*, December.

Lead-Zinc Accumulators.—Brief data on Leitner's lead-zinc accumulator, which is not yet in extended use. The weight of the round cell, including the celluloid receptacle, is 3.2 lbs., the diameter 2.2 inch, the height 10.2 inch when discharged with a constant current of 2 amp. in 8 hours 55 minutes, the voltage decreased from 2.56 to 2.1, which is regarded as the minimum to be allowed; the average voltage being 2.34, 18 amp.-hours and 42 watt-hours are available per cell, or 5.6 amp.-hours and 13 watt-hours per lb. of complete cell. Nearly the same data are given for Krueger's lead-zinc cell, in which the electrolyte is withdrawn by lowering a second tank connected with the cell by a flexible pipe, whenever the cell is not in use. Some other new cells are also noticed.—*Elek. Anz.*, Nov. 23.

Alkali Process.—KERSHAW.—A short article giving figures relating to the average working efficiency of the Hargreaves-Bird electrolytic alkali process (Digest, Dec. 9) over a period of 360 days. The average amperes were 2048, volts 3.9, current efficiency 93.4; 20.42 lbs. of NaCl were decomposed per electrical horse-power day. —Lond. *Elec. Rev.*, Dec. 1.

REFERENCE.

Electrolysis of Platinum Chloride.—DITTENBERGER and DIETZ.—A French abstract of the German article noticed in the Digest Sept. 23.—*L'Eclairage Elec.*, Nov. 18.

UNITS, MEASUREMENTS AND INSTRUMENTS.

E. M. F. of Clark Cell.—CARHART and GUTHE.—An account of an absolute determination of the e. m. f. of the Clark cell. Two cells of the Rayleigh H form as modified by Kahle were made in accordance with the specifications legalized by act of Congress in 1894, and did not differ more than one part in ten thousand. The e. m. f. was found to be 1.4333 volts at 15° C., a degree of accuracy being claimed of one part in five thousand. The cells were then compared with the standards of the German Reichsanstalt at Berlin. No. 2 was injured in transit, but it had been never more than one part in 10,000 lower than No. 1. No. 1 was found to be one part in 20,000 higher than the mean of all the normal Clark cells in both departments of the Reichsanstalt; this is well within the degree of accuracy attempted.—*Phys. Rev.*, November, December.

Names for Physical Quantities.—MARCHAIS LA GRAVE.—A communication referring to the proposition of Hospitalier (Digest, Nov. 25) and urging the following instead: If any quantity is the product of *a, b, c,* divided by the product of *d, e, f,* it may be called "*a b c* by *d e f*" ("par" in French). For instance, Hospitalier's linear mass would be called mass by length, etc.—*L'Eclairage Elec.*, Nov. 18.

Meter for Varying Rates.—An illustrated description of one devised by Rasch to register the energy at different rates for different times of the day. The current coils of all the meters are connected to the same feeder, as, for instance, the negative; the voltage coils are connected between one feeder as the negative, and a third line specially installed for this purpose running to the central station where it connects with a busbar which is connected to the positive busbar through a step-by-step resistance which is varied as desired at different times of the day to cause different rates to be registered. A special device is illustrated and described by which the voltage coils of the meters are connected automatically between the negative and the positive feeders whenever the voltage in the auxiliary conductor exceeds that of the other conductors at the consumer's end, owing to a lower drop, the object being to prevent the meter from registering too high.—*Elek. Rund.*, Nov. 1.

Compensating for the Distortion of Phase in Alternating Current Instruments.—A short illustrated description of a device adopted by Hartmann & Braun to compensate for the distortion of phase due to magnetic hysteresis, in an alternating current instrument whose fixed and movable coils are provided with cores of laminated iron. An induction coil is placed in series with the movable coil, and parallel with them an inductionless resistance is inserted so that the current, after flowing through the fixed coil, is divided into two parts; that flowing through the branch containing the induction coil then has its phase distorted relative to the line current, and this difference of phase must be brought to such a value, by properly proportioning the resistance and induction coefficients of the two branches, that it is equal to the phase difference between the current of the fixed coil and the induced magnetic field, due to hysteresis; the instrument then gives correct readings. The arrangement is shown in a diagram.—From *Elek. Rund.*; translated in Lond. *Elec. Eng.*, Dec. 1.

Meters.—An illustrated description of the Vulcain energy meter made by a French company. It is of the Elihu Thomson motor meter type and is made in several forms. The first, the "meter with dials," has special methods of suspension of the axis and of the adjustment of the break and a very high resistance in the shunt coil, it being 5000 ohms for a 110 voltage coil, so that the consumption of power is only two watts, or for 365 days of 24 hours, only 17.5 kw-hours. Another type is to be used for consumers which must pay in advance. It is an energy meter provided with a mechanism which is subjected to the action of a spring-wound up by dropping in a coin; by winding up the spring the circuit is closed; when the predetermined amount of energy is consumed the circuit is opened again. The details of the mechanism are described and illustrated.—*L'Ind. Elec.*, Nov. 10.

REFERENCE.

Instrument for Plotting the Wave Form of Alternating Currents. —FRANKE.—An abstract of his paper noticed in the Digest Dec. 9.—Lond. *Elec.*, Dec. 1.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Test of Pollak-Virag System.—A brief account with a facsimile of the message, of the recent successful test of transmission from New York to Chicago at the rate of 65,000 words per hour, the distance being nearly 1000 miles, which is the longest over which the system has ever been tested. The message itself says that the speed will be more than 80,000 words per hour. At Budapest the speed was 150,000. There will be no further tests here, as the inventors are returning to Europe. The arrangements for introducing the system in this country have not yet been completed.—*West. Elec.*, Dec. 9.

REFERENCES.

Wireless Telegraphy.—LAPIDGE.—A short popular explanation of the system.—*El'ty*, Dec. 13.

Printing Telegraph.—A reprint of the article on the zerograph, noticed in the Digest. Dec. 16.—*El'ty*, Dec. 13.

MISCELLANEOUS.

Electrical Progress.—S. P. THOMPSON.—The conclusion of his presidential address to the English Institution of Electrical Engineers. He thinks that the English should look to America rather than Switzerland when they desire guidance as to the future development of the railway problem; in an editorial in Lond. *Elec.* the reverse is claimed. He describes the development of conduit and surface contact systems and refers to one of the latter devised by Walker and himself. Of the New York conduit systems he says it seems "as if the object were to put as much cast iron as possible into the roads." He deals at some length with the commemoration of the centenary of Volta's discovery, by the Congress in Como. He draws attention to the fact that the whole question of financial development of new inventions in England is in a most unsatisfactory state, as it is almost impossible to find a middle course between a purely private affair and an overcapitalized swindle. In conclusion he refers to the recent trip of the Institution to Switzerland.—Lond. *Elec., Elec. Rev.*, Dec. 1; editorially discussed in Lond. *Elec.*, Dec. 1.

Refreshing Fatigued Iron Electrically.—An editorial note referring briefly to a method discovered by an Italian by which it is claimed

that iron which has become fatigued or tired, that is, has lost some of its mechanical properties, may be brought back to its original condition again by placing it in a solenoid through which an interrupted current passes. The report is not vouched for.—*El'ty*, Dec. 13.

New Book.

THE RISE AND DEVELOPMENT OF THE LIQUEFACTION OF GASES. By Willett L. Hardin, Ph. D. New York: The Macmillan Company. 250 pages, 42 illustrations. Price, $1.50.

The author of this modest volume is Harrison Senior Fellow in Chemistry in the University of Pennsylvania. He presents in it a history of the methods worked out in the liquefaction of gases, and gives data as to the condition of matter at the critical point. The theory of the gaseous and liquid states of matter and of the regenerative method of refrigeration are also set forth, and some account is given of investigations into low temperatures and of the industrial application of liquefied gases, although the last branch of the subject is in reality hinted at only rather than elaborated. In view of the fact that so little of the material here offered is now to be found in books, Mr. Hardin's volume has great and real merit, even if the rapid advance in this field should soon reduce it to the level of a memoir pour servir. The book is clearly written in a style which renders it available to general readers, many of whom will doubtless be glad to learn from it the actual truth and nature of the work done, chiefly during the past century.

BOOK RECEIVED.

THE "MECHANICAL WORLD" POCKET DIARY AND YEAR BOOK FOR 1900. Containing a Collection of Useful Engineering Notes, Rules, Tables and Data. Manchester: Emmott & Co., Limited. 244 pages, 95 diagrams. Price, 6d.

Directory of Electrical Societies, Etc.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, New York. Next meeting Dec. 27. Paper: "The Pacific Cable," by Capt. G. O. Squier.

CHICAGO ELECTRICAL ASSOCIATION, Chicago. Next meeting Jan 5, 1900. Paper: "Modern Construction of Dynamo Electrical Machinery," by H. R. King.

NEW YORK ELECTRICAL SOCIETY, New York. Next meeting Dec. 21. Paper: "Electricity Supply from Central Stations, Covering Recent Developments in the Construction and Operation of Central Stations in Our Great Cities," by J. W. Lieb, Jr.

NORTHWESTERN ELECTRICAL ASSOCIATION. Next meeting Milwaukee, Wis., about Jan. 17, 1900.

High Grade Transformers.

The Western Electric Company has issued a bulletin of S. K. C. transformers for which it is western agent, and to this pamphlet we are indebted for the accompanying cuts and information.

Figs. 1 and 2 represent a type of transformer ranging from 20 to 200 lights, Fig. 1 showing fuse boxes attached. Figs. 3 and 4 are of a type having a capacity from 300 to 600 lights, Fig. 3 showing the fuse boxes attached. Fig. 5 shows in detail the fuse boxes attached to the above-mentioned transformers. These boxes are detachable and can be used either on the transformers or attached to cross-arms, poles or building, as desired. They are single-pole porcelain cutouts enclosed in an iron box.

The heating guarantees of this type of transformer cover its use without oil. It is stated that while the use of oil is proper for transformers of extremely high voltage, for use on ordinary lighting circuits it is entirely unnecessary, if the transformer is properly designed and constructed. All of the transformers are provided with interchangeable secondaries so that they can be connected for either 1000 or 2000 volts. The sizes up to 150 lights are also provided with interchangeable secondaries so that they can be connected for either 50 or 100 volts for use on the three-wire system with 50 volts between the middle wire and either of the outside wires. The larger sizes are provided with interchangeable secondaries so that they can be connected for either 200 or 200 volts on the three-wire system with 100 volts between the middle and either of the outside wires.

In the design of the transformers the aim has been to obtain a close regulation, and at the same time, by the use of specially prepared iron and proper arrangement of the coils and iron, to reduce the core loss to a minimum. Moreover the regulation is made the same in all sizes to facilitate the maintenance of an even distribution of e. m. f. and also permit the proper running of the transformers in multiple. The transformers are primarily designed for operation upon circuits having a frequency of 60 periods, but if operated upon any higher frequency the core loss and heating will be less and the

FIG. 1.

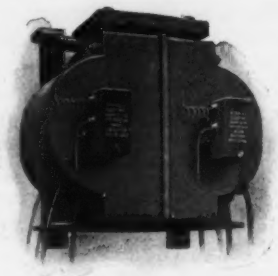


FIG. 3.

FIG. 2.

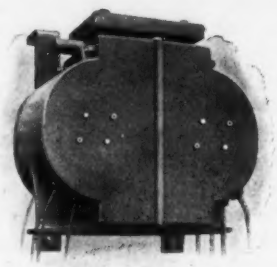


FIG. 4.

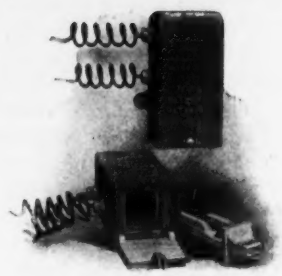


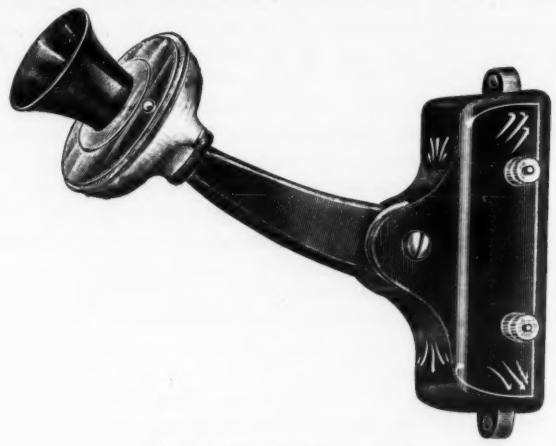
FIG. 5.

efficiency higher. It is guaranteed that the core loss of the transformers will not during their lifetime increase by "aging" more than 5 per cent., provided they are operated under normal conditions of load and temperature.

Williams-Abbott Improved Telephone Apparatus.

The Williams-Abbott Electric Company, of Cleveland, which has recently gone into the manufacture of complete telephones, has produced an instrument with several features somewhat out of the ordinary, the invention of Mr. W. J. Barr, who is associated with the company.

One of the most important of these features is the hollow transmitter arm, an illustration of which is shown herewith. This permits the passing of the conductor cord through the arm and through the joint into the base. The arm is provided with a new joint spring device which automatically takes up the wear, thus insuring



HOLLOW TRANSMITTER ARM.

perfect contact. The movement of the arm is perfectly smooth and it is easily adjusted. The transmitter is of the solid back type and the carbon used is of special make. The transmitter is sensitive and powerful. It is fastened securely to the cap of the transmitter cup, holding the diaphragm securely in position. The induction coil is very neatly mounted in the base by specially arranged clips on the terminals. The receiver is of the double pole type.

Since the company has been marketing telephones, it has made considerable improvement in the bell, which has long been standard

with telephone manufacturers. The magnets are of the four-magnet type, powerful, effective and durable. The new ringer is very loud and of improved mechanical construction, rendering it most durable. It is so fastened to the cover of the box that it will not readily become detached. A new hook, devised by Mr. Barr, is also a decided improvement. It furnishes excellent rubbing surfaces on the contact springs, and the latter are so arranged in an upright position in the box that the dust does not readily accumulate. The construction and finish of the instrument throughout is of the highest grade.

Electrical Musical Instruments.

Among recent applications of electricity in the playing of musical instruments, is the system of the Pianophone Company, 46 East Houston Street, New York, which shows much ingenuity in its development and in operation gives very satisfactory results. The company is producing self-playing banjos and self-playing attachments for pianos, the electric current doing all the work, no wind instruments or apparatus whatever being employed. The construction and operation of the self-playing attachment for the piano and of the "banjophone" will be understood from the following description:

A 1-50-hp electric motor is placed inside of the piano case at the base, and is belted to the mechanism which unrolls the perforated music roll and to a long steel roller. Over this roller, which lies in a horizontal position, and which forms the common return for all the key circuits, is a row of 58 small horse shoe electromagnets set vertically in a frame, with their poles upwards. These electromagnets are about 3 inches long and less than an inch wide, and are set close together. Each magnet represents one key on the keyboard. Immediately above the roller is a frame carrying a set of small contact brushes of wire, of which there are as many as there are magnets, or keys. Each brush is the terminal of a circuit which includes one of the magnets, the roller being the other terminal.

ELECTRICAL SELF-PLAYING ATTACHMENT FOR THE PIANO.

The perforated music paper passes over the roller and under the contact fingers, and as the perforations pass under the fingers the latter come into metallic contact with the roller underneath, thus closing the circuit through the corresponding magnet. On thus closing a circuit the armature of its magnet bears down upon a short wooden rod, to the lower end of which is loosely pivoted a cam of wood with a felt bearing surface. As this cam is pressed down by the rod it bears upon the surface of the revolving roller and is carried forward and outwardly in the direction of the rotation of the roller. This tangential motion is imparted to another rod pivoted to the cam at a point on its edge about opposite the rod first referred to. This second shaft or rod lies in an upward direction and its motion is, consequently, upward, corresponding to the downward motion of the armature. At the upper end of this shaft is a hammer covered with felt, which strikes the proper string, with a quick, sharp blow, whenever the corresponding circuit is closed through the magnet. This description of the operation of one magnet, of course, applies to all 58, their operation being controlled entirely by the perforations in the music roll.

The motor used for this work is rated, as already stated, at 1-50-hp. It is the bipolar type, with one magnetizing spool. It is provided with semi-circular pole pieces which almost completely encompass the gramme ring armature. The motor is operated by one cell of storage battery, taking 4 amperes at a pressure of 2 volts. The Pianophone Company makes these motors itself.

The mechanism for the playing of the banjo is somewhat different to that used for the piano. Behind the neck of the instrument, which stands upright in a cabinet, are four parallel vertical rows of solenoids, 11 in each row, or 44 in all, there being 44 notes on the banjo. The axes of the solenoids are at right angles to the neck of the banjo. To the core of each solenoid is attached a wire rod which passes through the neck, the end of the rod being flattened and bent at right angles over but normally clear of the string underneath. These finger pieces "fret" the instrument. When a current passes through a solenoid the core is drawn in and the finger presses down upon the string. When this occurs another action takes place simultaneously, i. e., the picking of the string and the sounding of the note.

Parallel with the neck of the banjo are four steel rods which lie close to the cores of the vertical rows of solenoids. Down each rod at points corresponding with the levels of the different solenoids is a pin, and from the core of the solenoid projects a similar pin. When the solenoid is energized, the pin on the moving core engages that on the vertical rod and turns the latter on its axis. At the lower end of the rod is a projecting finger which "picks" the string when the shaft is thus turned. All four rods are alike, and it is evident that the operation of the solenoids frets the string and strikes or picks it at the same time. The solenoids are controlled in precisely the same manner as the magnets are in the piano attachment.

In the case of the piano it is claimed that the mechanism can be so controlled as to perform with unexcelled technique and accuracy of tempo any musical composition ever written.

Banjos are made with an orchestrion attachment, including snare drum, cymbals and triangle, all of which are operated by means of electromagnets and solenoids.

A feature of the business is the music perforating machine, which is electric and entirely automatic in its operation. The machine is operated in a manner similar to that employed in the operation of the piano and banjo mechanism, the perforations in the "Original" copy of music causing circuits to close through electromagnets which set punches, these in turn perforating the paper and producing an exact copy of the original. This machine perforates 15 sheets of paper at one operation at a paper speed of 2 feet per minute or a total of 15x2=30 feet of paper per minute.

These devices are the invention of Mr. G. Howlett Davis, who is president and general manager of the Pianophone Company.

Electricity in Textile Mills.

The presence of frictional electricity, generated by the motion of belts, pulleys, running stock and machinery, is a source not only of annoyance but of positive loss to textile mill owners. In carding and spinning particularly, electricity has the effect of causing a change of several numbers in the yarns, causing it to snap and break; while the quality and width of the woven goods is noticeably affected. Futile attempts have been made to conduct away this troublesome electricity, but all parts of the machine cannot be properly connected for the purpose, and a resulting residue of electricity is sure to make itself known. It is well understood that on moist days, by atmospheric condition, the electricity escapes as fast as produced; while on dry days it is insulated in belt, machine and stock, and cannot escape into the air, for dry air is a poor, while moist air is a good conductor of electricity. Moisture evidently plays a very important part in electrical troubles, and various attempts have been made to imitate the action of the moist atmosphere by admitting water to the mill rooms on dry days. The effect which moisture in the air has upon electrification in the rooms appears to be dependent upon, and increases with its temperature. With the relative humidity above a certain per cent., no trouble is experienced; as this per cent. decreases, the electricity makes its appearance, and grows to be more and more annoying.

A careful consideration of these statements will satisfactorily prove that the whole question of escaping from electrical trouble will

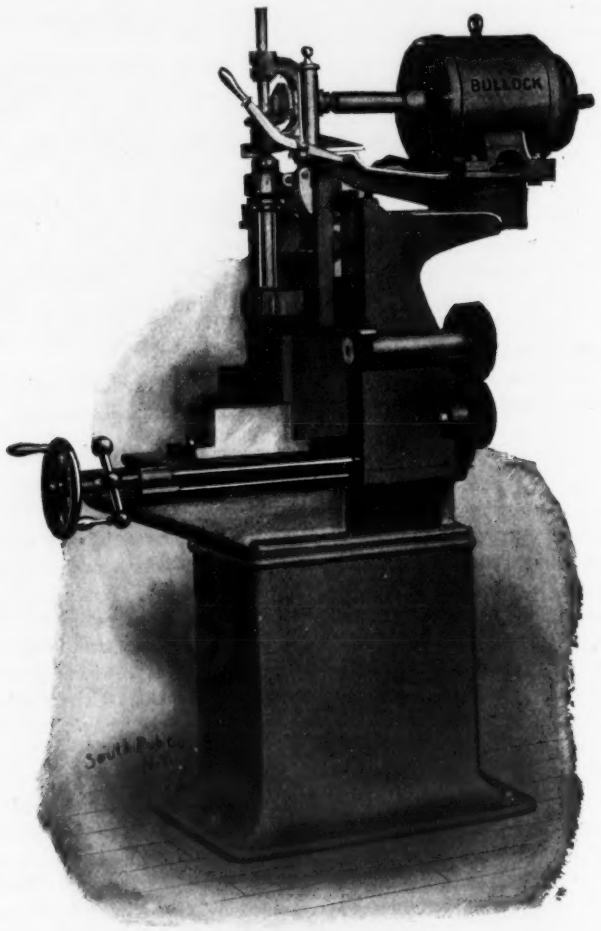
be found in the matter of relative humidity. If there is sufficient moisture in the atmosphere, there is no trouble; if there is not sufficient moisture, electricity always appears.

As moisture depends upon the currents of air to distribute it, no better means can be found that the blower system for obtaining the required results. While doing efficiently its duty as a heating and ventilating medium, the air may be moistened to any desired degree by sprays or evaporating pans in the passages from the heaters to the rooms. The exact humidity of the air may be noted by a hydrometer, and regulated to the closest degree. With an average temperature of 70 to 80 deg. in the room, the per cent. of humidity need not exceed 70. This will insure a comfortable atmosphere, and will absolutely prevent the presence of any electricity. The mere benefit from this particular source will repay any enterprising owner for introduction, in these days when a saving of a fraction of a cent per yard is of vital importance. But with the additional advantage of an efficient heating and ventilating apparatus, controllable under all conditions, there can be no hesitation as to the desirability of the system.

The above extracts from "A Treatise on Ventilation and Heating," by B. F. Sturtevant Co., Boston Mass., recall some letters which appeared in the columns of the ELECTRICAL WORLD some years ago, on trouble from electricity in press rooms and the remedy therefor. The remedy indicated in the correspondence as having been found efficacious, consisted in keeping the atmosphere is a humid condition.

Electrically Driven Profiler.

The accompanying illustration shows an electrically driven profiling machine embodying a unique method of applying the power. As is well-known, it is rather difficult to directly apply an electric motor to a profiler without intermediate belting, owing to the fact that the



ELECTRICALLY DRIVEN PROFILER.

distance between the motor and spindle is constantly changing by reason of the shifting of the carriage. To surmount the difficulty of a constantly varying length of shaft, the Bullock Electric Manufacturing Company, Cincinnati, Ohio, places the motor upon a revolving base and connects the motor and spindle by means of a splined shaft and sleeve. The shaft sliding within the sleeve allows for variation in the distance between motor and spindle.

American Machinery Exhibit at Paris.

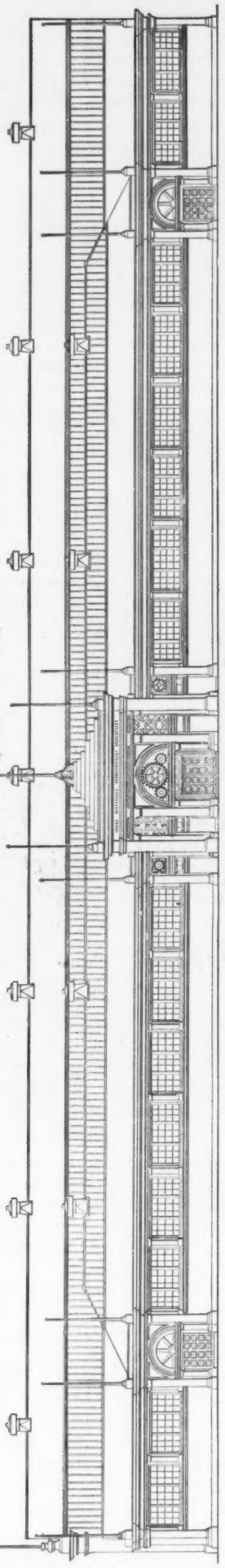


FIG. 1.—FRONT ELEVATION OF THE BUILDING.

One of the most interesting features of the Paris Exposition to engineers and machinists will be the special "machine shop" building, to be put up specially, as suggested by Mr. F. E. Drake, director of the United States Department of Machinery and Electricity, for the display of tools which could best be studied in operation. This building, material for which has already been shipped by United States Commissioner General Peck to Paris, will be located at Vincennes, about five miles from the main exhibit, and in association there with the exhibits of transportation material, automobiles, bicycles, etc.

We illustrate herewith the plan of the building, designed and fabricated by the Berlin Iron Bridge Company, the steel being furnished by the Carnegie Steel Company, Limited. It consists of a steel skeleton, the walls being wood and staff, plastered inside. It has a total length of 346 feet 8 inches and a width of 126 feet 10 inches, composed of two main parts and two wings. This amplification was necessary because, after the original structure had been designed, the exhibitors seeking space were so numerous that an addition was made necessary. The four aisles measure, in the main parts, 45 feet 5 inches and 33 feet, the two wings being each 22 feet 2 inches in width.

As it is the intention to make this building strictly an operative exhibit throughout, with all tools running, a power plant was needed and this has also been provided, as will be gathered from the plans. Power is to be furnished by two Climax boilers of 250 horse-power each and an Erie-Ball tandem compound engine of 300 horse-power. The engine will be connected to a Bullock 200 kw generator. The steam plant is provided with a Blake pump and a Wainwright heater. In addition to supplying steam to the engine the boilers will furnish steam to an Ingersoll-Sergeant air compressor, which will thus operate pneumatic tools in the exhibit and will furnish air to the railroad exhibit near by. Electricity will be used throughout the building. The main aisle, so to speak, will be traversed by a Shaw electric crane spanning 33 feet, with a clear lift of 21½, and driven by three motors. There will be no line shafting. Small tools will be grouped as far as possible and run from short counters, while the large tools will carry their own motors of types selected by each exhibitor. In this way the exhibit will conform also to the original general idea governing all the manufacturing exhibits, i. e., not to bunch them all in one machinery building merely, but by the use of electric motors to group the productive machine with the raw material it works up and with the finished articles.

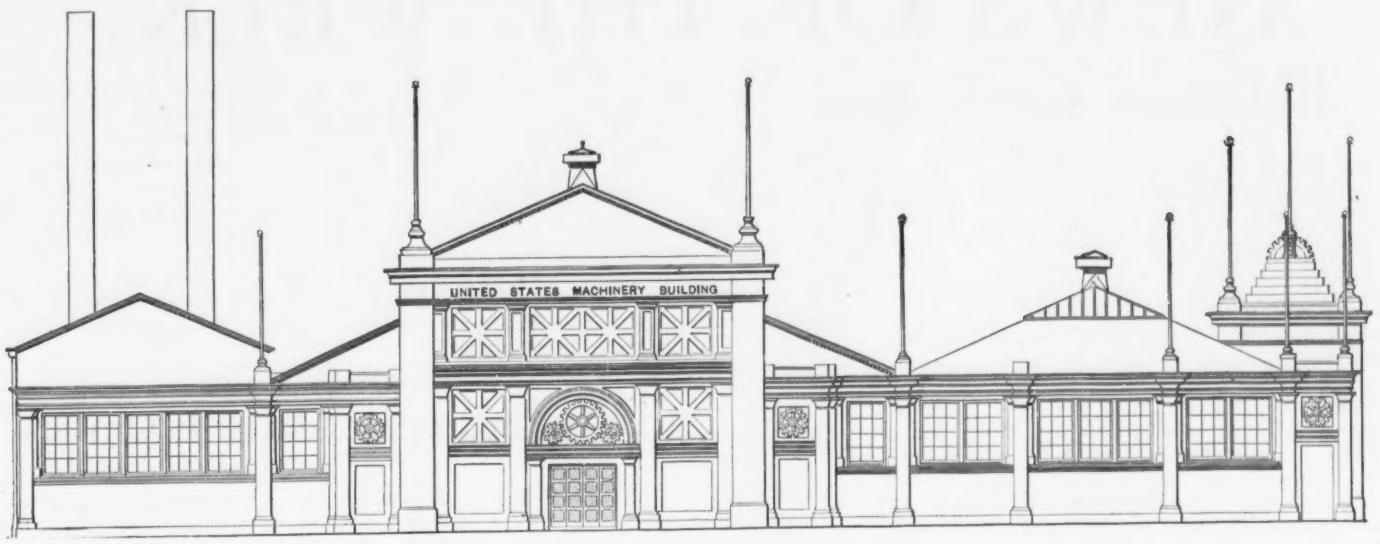


FIG. 2.—WEST ELEVATION.

PARIS EXPOSITION OF 1900

PLAN OF U. S. SPACE AT BOIS DE VINCENNES

Showing Official Allotments

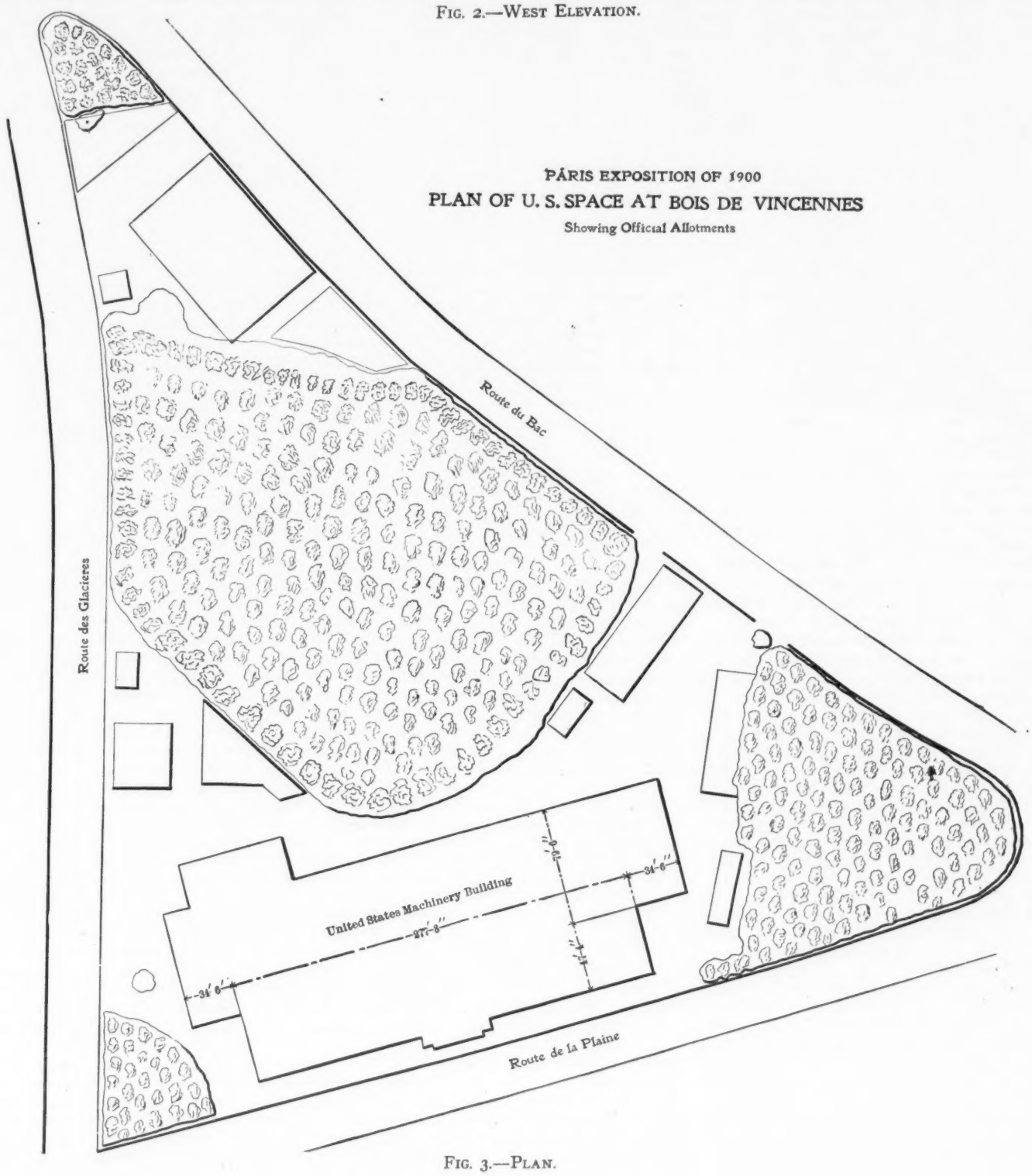


FIG. 3.—PLAN.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was very much perturbed, the main cause being the instantaneous response of American markets to the depression in England due to the series of reverses in the Transvaal war. Secondary to this came the collapse of much of the speculation in Boston, beginning in copper and running into many other lines. There is reason to believe that the current week may see further response in New York, but when it is all over, conditions will be better, although it is impossible for financial affairs to improve here unless they also brighten up in England and on the continent, where the scramble for gold is becoming rather sharp. During the week 6462 shares of Western Union were sold, rising ¼ to 87½. General Electric, like most other industrials, went "way off," and on sales of 11,475 shares, fell again 5 points, closing at 119. All the transportation specialties were weak, Metropolitan Street Railway going off no less than 16 to 167 and Manhattan Elevated 4⅝ to 96¼. In Boston, American Bell Telephone closed at 340 bid; Erie Telephone, 100-103; Mexican, 3-3¼; Michigan, 100; New England, 140; Boston Elevated, 94; West End, 89; pref., 115; Mass. Elec. Railways, 18; pref. 73½. In Chicago, National Carbon common closed at 16; Metropolitan "L," pref., 76½-77⅛; Union Traction common, 29½; pref., 79. In Philadelphia, the market was weak and downward. Electric Storage Battery closed at 113¼ common and 112½-113, pref.; Penn. Elec. Vehicle Co., 9⅛ common, 4⅛ pref.; Union Traction, 39⅛; Phila. Traction, 95¼-95⅜; National Electric, 5⅞; Am. Railways, 5⅜; Gen. Elec. Automobile, 4-4⅛; Consol. Traction, N. J., 63½; Consol. Traction, Pittsburg, 27½. In the New York outside market, Electric Axle Light & Power Co. closed at 6½; Electric Boat, 23 common, 35-45 pref.; Electric Vehicle, 63-69 common, 100 pref.; N. Y. Elec. Vehicle Transportation, 11-12, New England, 6-6½; Illinois, 2½-2¾; Otis Elevator, 20-23 common, 88-90 pref.; Barney & Smith Car, 22-25 common, 95 pref.

A BAD BREAK IN STOCKS this week has been the result, as anticipated above, of the bad news from South Africa, it being recognized at once that England's welfare and our own are closely associated, while the direct effect was the selling out in London of large quantities of standard American railway shares. The consequent slaughter in prices on Monday was terrific, and while industrials were sorely punished all other classes of securities were seriously hurt. General Electric actually went as low as 111 and closed at 115½. But New York Central went off from 127½ to 121, a decline nearly twice as great. Metropolitan Street Railway opened at 165 and went off to 155. Electric Vehicle common was quoted at 45-53. In Boston, American Bell Telephone slid off to 335. In Philadelphia and Chicago, all stocks were also off. At the close there was improvement due to the action of the banks in offering several millions in loans, but speculation has had a check that will hinder it for some time from becoming rampant.

NEWARK (N. J.) TELEPHONE.—A short time ago it was stated that the independent Newark Telephone Co. had been acquired by the new Telephone, Telegraph and Cable Company of America. Then it was stated that the Bell interests had acquired the majority control of its $300,000 stock and $300,000 bonds, the price paid for the stock being $3, with the par value $10. Now it is announced that this week Sheriff Virtue, of Newark, N. J., has received an execution against the Newark Telephone Company. It is issued upon a judgment for $86,881.46 obtained a short time ago by Thomas A. Nevins in the Supreme Court, in an action brought on an account for construction work performed by the plaintiff for the defendant. Just what it all means is not clear, but a safe inference is that somebody dropped a lot of money over this enterprise.

DIVIDENDS.—The American Steel & Wire Company has declared a quarterly dividend of 1¾ per cent. on its preferred stock, payable Jan. 2. The Manhattan Railway Company has declared a quarterly dividend of 1 per cent., payable Jan. 2. The Western Union Telegraph Company has declared the regular quarterly dividend of 1¼ per cent. Announcement was made of the regular quarterly dividend of 2 per cent. on Electric Vehicle common, and this very favorably affected that stock. The last sale prior to the declaration of the quarterly dividend was made at 59, and from this figure the bid rose to 65. It closed at 63 on Saturday, while at the close of the previous week no bid at all could be had for the stock.

CHICAGO TRACTION.—At a special meeting of the stockholders of the Chicago Union Traction Company last week, four new directors were elected as follows: William Dickinson and John V. Clark, Chicago; Walter F. Johnston and Henry H. Collins, New York. The office of third vice-president was also created and ex-General Counsel Walter H. Wilson was elected to the position. A quarterly dividend of 1½ per cent. was declared on the preferred certificates. It was officially stated that negotiations are progressing for the purchase of the Chicago Consolidated Traction Company.

TROLLEYS IN NEW YORK STATE may be somewhat affected by the action of the New York Central Railroad if it be true that that important steam system is to enter into active competition with the trolleys at points where the local traffic will justify such a course. On the other hand, the trolleys have the ability to make it unpleasant for the Central, which might better follow the policy of the Pennsylvania in acquiring control of some of the trolley roads and operating them for profit or as feeders.

BOSTON ELECTRIC LIGHT CO. has declared a quarterly dividend of $2 per share, payable Jan. 15. This increases the old rate of $1.50 and makes the stock an 8 per center., as it is understood that the rate can be maintained.

Commercial Intelligence.

THE WEEK IN TRADE has been a very active one in almost all respects and lines, save for the fact that the open winter has checked the demand for coal, furs and heavier wearing apparel. In spite of the extreme depression in stocks, industry has pursued its even tenor, although it is possible that speculative losses may hinder Christmas purchases a bit. Dun's Review says that the depression in stocks has displayed the great divergence between the trading and the productive industries of the country and its speculation. "Never," it says, "has production been greater, the number of hands employed larger, the wages distributed higher, or the purchasing power based upon earnings, than at this time, and never have conditions of trade or returns of earnings and traffic given certainty of greater business for transporters. Yet as the earnings of the railway and manufacturing companies mount upward their stocks decline, as if it were disastrous for a road to double its earnings and ruinous for a mill to realize unprecedented profits. Inflated capitalization has of course done much harm, and speculative excitement has counted profits in many cases long before they were earned." During the week, iron and steel were firm, and copper as we predicted has fallen, Lake being quoted at 16 5-16, and Electrolytic at 15 13-16; lead 4.65 and tin 24⅞. Failures for the first week of December were $2,766,496, manufacturing $513,328, and trading $1,574,091. Failures for the week were 218 in the United States against 261 last year, and 26 in Canada against 31 last year.

ELECTRIC CARRIAGE MANUFACTURE is proceeding apace, and we are informed by Mr. R. McA. Lloyd, president of the Electric Vehicle Company, that they have now acquired the Hartford Cycle Works, at Hartford, Conn., and have turned in an order there for some 2000 of the lighter types of electrical vehicles which the machinery of the factory is suitable to produce. He states that the company has arranged to work in conjunction with the main Columbia bicycle European office in Paris, branch offices in every country on the continent and in England. Mr. Hart O. Berg was recently here on that mission to arrange details. The German firm of Ludwig Loewe & Co., and the French firm of Clement & Clement, the two largest manufacturing firms on the continent, will do that part of the automobile manufacture which there would be no profit in doing here. On account of the great space, says Mr. Lloyd, that automobiles occupy in comparison with their weight, it has been found unprofitable to send the completed machines from this country. Parts of them are made here, the rest at the factories in Paris and Berlin, and the whole machines then set up over there. In this extension of its trade the American firm also hopes to derive considerable benefit by keeping in touch with European makers and inventors. The methods used by the Electric Vehicle Company are unknown in Europe. European firms have manufactured machines and then sold them to individuals. The policy of the American concern, as well known to our readers, is not to sell a machine unless a customer demands it. Instead, it establishes branch operating companies, where machines may be rented and where they may be repaired when out of order. When a machine of an 1899 pattern, for instance, is out of style for pleasure use, it may be rented to a business firm for a delivery wagon, the next year to a peddler at a reduced rate, and so on until it is completely worn out. If it had been sold in the first year and the original buyer had kept it, it might have been worth after the first year no more than junk. In this way a large number of machines can be manufactured and kept in continuous service until they are actually worthless instead of merely out of style. The New York vehicle hire rates are quoted in this issue. Neither the American automobile companies nor those of Europe can at present fill orders even approximately. The reason for this is that there are only a comparatively few skilled carriage mechanics, and that the number cannot be rapidly increased, and that even if it could, it would be difficult to put two men at work where one works now. The upholstering of an automobile cab, for example, takes one man about two weeks. Two men could not do the work any quicker, because there is not room

inside an automobile cab for two men to work together. Moreover, as it requires about three years' apprenticeship to make a skilled "body-maker," it will be some time before the supply of workmen available for work on motor carriages will be noticeably increased. As conditions now are it takes about six months to make a fine motor carriage. The Electric Vehicle Company has recently received valuable concessions from the Mexican government and an operating company is soon to be established in the City of Mexico. No branches have yet been established in Asia or South America, for the reason that the demands of this country and Europe are so far from being supplied that no attempt has been made to extend operations farther.

LABOR-SAVING ELECTRICITY.—The Baldwin Locomotive Works were never so busy as now, and in November, with only 25 working days, they turned out 92 new locomotives. The rapidity of output is attributed to the use of electricity and particularly to the employment of electric cranes and tools. Referring to this subject, the Philadelphia *Ledger* remarks: A look into the Baldwin Works, where 7250 men are now at work, gave some insight into the methods by which such rapid work is done. The introduction of electrical machine tools has made a revolution in some branches of the manufacture. When two electric cranes were put into the erecting shop, a few years ago, they dispensed with 300 men. One man now, by lifting his hand as a signal to the motorman, can at once pick up a smokestack or other heavy part, and set it in place; the entire movement being under the direction of one will; the whole thing being done before he could have assembled his men under the former method. In the boring building the introduction of motors to operate the lathes also made it possible to use electric cranes, as these could not have been used in conjunction with the old-time shafting. It is interesting to note that the introduction of these labor-saving machines was a distinct advantage to the workmen, who now turn out more work and get better pay for it than before. From present indications the year 1900 will witness the greatest business in locomotive building yet seen, not only in numbers, but very much more in tonnage, as the average weight of engines built to-day is 65 per cent. greater than the average of ten years ago.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following is a list of the exports of electrical material from the port of New York, for the week ended Dec. 16: Antwerp, 22 cases electrical material, $1711; Argentine Republic, 20 cases electrical material, $133; 145 cases electrical material, $6844; three cases electrical machinery, $664; British West Indies, 21 packages electrical material, $1347; Brazil, 104 packages electrical material, $3177; Belfast, 53 packages electrical material, $970; British Australia, 102 packages electrical car material, $11,851; Bradford, 2 cases electrical material, $150; Cuba, 8 cases electrical material, $183; Chili, 60 cases electrical material, $1302; China, 1 case electrical machinery, $50; Central America, 67 cases electrical material, $1297; 3 cases electrical machinery, $48; Havre, 1 case electrical machinery, $80; London, 222 cases electrical material, $17,651; 21 cases electrical machinery, $930; Liverpool, 100 cases electrical material, $7055; 17 cases electrical machinery, $2464; Manchester, 16 cases electrical machinery, $1065; Mexico, 56 cases electrical material, $450; Newcastle, 6 cases electrical material, $325; Porto Rico, 5 cases electrical material, $210; Peru, 32 packages electrical material, $1541; U. S. Colombia, 2 packages electrical material, $29.

VALLEE BROS. & CO.—Mr. John L. Hall, who six months ago assumed the management of the dynamo and motor department of the electrical house of Vallee Bros. & Co., 625 Arch Street, Philadelphia, has made a remarkable record with the Bullock machines, which this house represents. Some of Mr. Hall's sales in the period are as follows: 150-kw railway generator, Delaware, Lackawanna & Western Railroad, Scranton; 100-kw engine type, John Wanamaker, Philadelphia; three 50-hp teaser equipments for sextuple Hoe presses, *North American*, Philadelphia; 110-hp direct connected motor, Edison Electric Illuminating Co., Hazleton; 42½-kw Pioneer Knitting Mills, Plymouth, Pa.; 12½-kw Scranton Electrical Construction Co.; 30-kw P. J. Courtney, Philadelphia; 17-kw E. H. Diener, Darby, Pa.; 17-kw Henry Wanklin, Philadelphia; 9-kw Blue Ridge Knitting Co., Hagerstown, Md.; 9-kw Branning Manufacturing Co., Edenton, N. C.; 8-kw F. A. Bruner, Philadelphia; 8-kw Barnes & Co., Philadelphia; 12-kw C. S. Davisson & Co., Chester, N. J., and a large number of other orders for generators and motors.

THE B. F. STURTEVANT CO., of Boston, Mass., reports an increase of nearly 40 per cent. in the volume of its business for 1899 over that of the previous year. The shipments, both foreign and domestic, included fan blowers for all purposes, heating, ventilating, drying and mechanical draft apparatus, engines, electrical apparatus, etc. During the past year an addition covering 20,000 square feet has been made for the use of the electrical department, which has shown the most rapid growth, the output having more than doubled during the year, and covering principally electric fans and special generating sets. The sale of mechanical draft apparatus has been practically quadrupled, while the output of engines has increased one-third over that of the preceding year, and has included many special designs. Numerous special orders for electric fans and generating sets for the Navy Department are being filled, and the construction of a complete line of enclosed motors of new design is now under way.

NEW YORK AIR COMPRESSOR CO.—Announcement is made of the organization of the New York Air Compressor Company under the laws of the State of New Jersey. The capital stock of the company is $100,000, and a complete foundry and machine shop plant has been purchased on the line of the New York & Greenwood Lake Railroad at Arlington, N. J. Contracts have already been let for a full modern equipment of tools. It is intended to manufacture a complete line of air compressing machinery at the new plant. The officers of the company are: J. W. Duntley, President; Alexander MacKay, Vice-President; W. P. Pressinger, Secretary and Treasurer. The directors are: J. W. Duntley, Alexander MacKay, W. P. Pressinger, William B. Albright, W. O. Duntley, Thomas Aldcorn and Austin E. Pressinger. The New York offices of the company are at 120 Liberty Street.

NEW STERLING TELEPHONE FACTORY.—Since our last issue the Sterling Electric Company have removed their plant to LaFayette, Ind., where they have a new factory which will enable them to keep pace with the growth of their business. The new building is 225 feet long and 60 feet wide in the main, with a wing of the same width and 100 feet in length. It is three stories high and the Sterling Company, we understand, own and occupy the whole of it, thereby giving them, they claim, the largest plant in the United States devoted exclusively to the manufacture of telephone apparatus. Much new machinery and many new and novel devices have been added, and the company will soon employ some five hundred people. One of the results of this move on their part will be the early placing on the market of a full line of telephones for all branches of service.

TELEPHONE MATERIAL is in pretty active demand these days, and the number of new exchanges springing up is considerable. It is understood that the new independent interests in New York City are now inviting bids and proposals for their first exchange and switchboard. In the meantime, the old line Bell companies are going in heavily for improvements and extensions in every direction. For example, it is estimated that the new capital now being raised by the Erie Telegraph & Telephone Company of $10,000,000, will pay the cost of increasing the list of subscribers from 105,000 to 200,000 at the rate of about 50,000 per year and a proportionate increase of the company's long distance service and the completion of 30 exchange buildings now in process of construction which, when completed, will give the company 62 exchange buildings.

THE GENERAL ELECTRIC COMPANY'S factory methods were the subject of a recent interesting article on the New York *Evening Post*. Many of the details would be quite familiar to the readers of this journal, but the gross statistics quoted are noteworthy from their bearing on industry in general. At present the three factories at Harrisburg, N. J., Schenectady, N. Y., and Lynn, Mass., employ 11,700 hands, have a weekly payroll of $143,000, the buildings cover an area of about 160 acres, on which are about 2,000,000 square feet of floor space, which is being increased every month. The principal metals used are copper and iron and steel, about 1000 tons of the former and about 3000 tons of the latter being used every month.

APPARATUS FOR SPAIN.—Mr. Theodore Mertens, for the last fifteen years American Consul at Valencia, Spain, informs us that he would like to secure price lists and catalogues of American electric lighting apparatus of all kinds, from concerns desirous of extending their export trade. His address is Alameda 6, Valencia, Spain. Mr. Mertens does not mention any specific plant, but says his inquiry has special reference to dynamos, motors, ventilators, voltmeters, ammeters and other appurtenances. He considers that the outlook for the sale of such apparatus in Spain is better than it has been for a long time.

WESTERN ELECTRIC PLANTS.—Williamson & Co., of Cleveland, O., have placed a contract with the Western Electric Company for three 100-kw 125-volt direct connected generators to be installed in the Williamson Building. These will be direct connected to Ball engines and will be installed by the construction department of the Western Electric Company. The Sargent Company, of South Chicago, manufacturers of iron and steel castings, have increased their facilities and have placed an order with the Western Electric Company for one 150-kw 125-volt belted generator.

KEEP THE CONSULS POSTED.—Our consul, Albion W. Tourgée, of Bordeaux, suggests that it would be advisable for exporters to let the consuls know something about the success or failure of the enterprises in which they engage in their districts. As it is now, they write asking information about dealers, opportunities, etc. The consul writes many letters to get the information the exporters want, and tells them what they must do and then hears nothing more from them.

Special Correspondence.

NEW YORK NOTES.

New York, Dec. 18, 1899.

MR. W. M. SHEEHAN has taken offices at 136 Liberty Street, where he will be pleased to receive communications regarding electrical construction work and electrical supplies.

SCHEDULE OF AUTOMOBILE RATES.—The New York Electric Vehicle Transportation Company has published its schedule of rates for the hire of vehicles at the station and for hacking. The minimum station rate is $1 for the first mile and 50 cents for each additional mile or fraction thereof, and the minimum hacking rate is 50 cents per mile.

MR. T. W. MEACHEM, president of the New Process Raw Hide Company, of Syracuse, who first came actively into touch with the electrical trade some ten years ago in supplying pinions for trolley work, has lately found a new line added to his business by the automobile industry. When in New York lately he spoke very hopefully about the developments in that line. He has just got up a new circular addressed to automobile manufacturers.

AUTOMOBILE PERMITS REVOKED.—Park Commissioner Clausen has revoked the permit granted Mr. Jefferson Seligman to run an automobile in Central Park. A similar permit to Mr. Isaac L. Rice was also revoked. Both these gentlemen assert that they have complied in every way with the provisions of their permits. Commissioner Clausen states that both Messrs. Seligman and Rice have evidently misunderstood the privileges conveyed by the permits.

THE BALL ELECTRIC COMPANY, once well known in the field of dynamo construction, has been pulled together again in good shape, and organized recently for the manufacture of arc dynamo and lighting apparatus, with factory at 404 West Twenty-seventh Street. The officers are: W. L. Brown, president; R. E. Ball, vice-president; J. S. Bell, secretary and treasurer. R. C. Garhart is the general manager. The capital stock of the new concern is $300,000.

AUTOMOBILES BURNED.—A fire on Saturday night last destroyed the third and fourth floors of the building at 211 East Forty-third Street, occupied by the construction department of the Electric Vehicle Company. Forty-three new automobiles were burned. The fire is supposed to have started in the room where the rubber tires are kept. A. L. Stevens, manager of the manufacturing department of the Electric Vehicle Company, said he could not estimate its loss, upon which there is insurance. The machinery and several finished automobiles on the lower floors were saved.

THE KINGSBRIDGE FRANCHISE.—The directors of the Third Avenue Railroad Company have accepted the conditions imposed by the Board of Estimate for the franchise for the Kingsbridge, Fort George & Eleventh Avenue railroads. The city wants 4 per cent. of the gross receipts of the lines for the first five years, and 2 per cent. additional each five subsequent years until 10 per cent. is reached. The Third Avenue Company has built a $2,000,000 power house at 210th Street and Kingsbridge Road, and has spent $1,000,000 in other improvements. The country through which the roads pass is not built up now, and the company expects that it will be 12 or 15 years before they can earn operating expenses. On account of the company's investment, however, it was said, it was decided to accept the city's terms.

STEAM AND ELECTRICAL ENGINEERING AT COOPER UNION.—A steam-electrical plant is being installed at Cooper Institute in this city for the use of students, to enable them to study the practical operation of an electric generating plant. It will cost $5000. It comprises a 40-hp high speed engine, condensing apparatus and two 10-hp electrical generators. The steam engine is fitted for use as a test engine. Among its features are an indicator for gauging the steam pressure in the cylinder and a friction brake for determining the power of the engine. The generators may be used as motors or rotary transformers, and when driven by the engine they will generate a direct or alternating current or both at the same time. The plant will be used by the fifth year and special students of the branch of physics.

THE INTERNATIONAL AUTOMOBILE CUP RACE IN FRANCE.—The Automobile Club of America, at a recent meeting at the Waldorf-Astoria, took steps to have this country represented at the first race for the International Automobile Cup in France in July next. It was decided to appoint a committee of three to examine any automobiles whose owners desire to enter in the international race and test them. If, in the opinion of the committee, the carriages have a fair chance to win and the owners are willing to post the $600 entry fee, it is authorized to perfect the entries. If more than three carriages are offered the committee will hold trial races to determine which are the most worthy to represent the Automobile Club. Belgium has entered three automobiles for the race, and it is believed that England will be represented.

METROPOLITAN RAILWAY DIRECTORS.—At the annual meeting of the stockholders of the Metropolitan Street Railway Company, held a few days ago, nine directors were elected, as follows: H. H. Vreeland, W. L. Elkins, Thomas Dolan, Charles E. Warren, P. A. B. Widener, Thomas F. Ryan, D. B. Hasbrouck, H. A. Robinson, and Harry P. Whitney. R. L. Anderton, Jr., D. C. Moorehead and John T. Little, Jr., were appointed inspectors of election. Directors elected by the Twenty-eighth and Twenty-ninth Street Crosstown Railroad Company's stockholders at their annual meeting were H. H. Vreeland, D. B. Hasbrouck, P. A. B. Widener, W. L. Elkins, Thomas Dolan, Thomas F. Ryan, C. E. Warren, H. S. Beattie and Henry A. Robinson. The inspectors of election chosen were the same of those of the Metropolitan Company.

Niagara Falls, N. Y., Dec. 9, 1899.

THE NIAGARA GORGE RAILROAD COMPANY has decided to operate its road all winter. Last year the road was idle during the winter season.

THE INTERNATIONAL TRACTION COMPANY has protected its line at various points between Niagara Falls and Buffalo by the erection of snow fences.

THE DUNKIRK FRANCHISE.—In the Supreme Court Justice Hooker has denied a motion for the continuance of an injunction against the city of Dunkirk, restraining that city from granting a franchise for a street railway. The trouble arose over competition.

ELECTRIC POWER FOR CEMENT WORKS.—The Helderberg Cement Company, of Albany, has closed a contract with the Empire State Power Company providing for the supply to the cement company of electrical power for the operation of its works at Howe's Cave. The power company is now constructing a plant at Schoharie Falls, on the river of the same name. A transmission line will be constructed to Howe's Cave, which will be of sufficient capacity to deliver to the works of the cement company 1500-hp, and a similar line will deliver to the city of Amsterdam 3000-hp. Contracts for the construction of these lines will be let within a few days, and they will be followed by others for the construction of similar lines to convey power to other places which the Empire State Company will supply.

THE CANADIAN POWER COMPANY, in which Banker Paine, of Niagara Falls, Ont., and A. C. Denniston, of Philadelphia, are interested, has changed its name to the Dominion Power Company. This company has a franchise from the Dominion government to take water for power purposes from Chippewa Creek, and its purpose is to carry it to a point near Victoria Free Park, where sufficient head will be obtained. The company has been mixed up in the power agitation on the Canadian side and its plans have been delayed. It is now stated that General Fields, of Buffalo, is representing capital that has or is thinking of becoming interested in the project. It will be necessary for the company to secure the consent of the government of the province of Ontario to the erection of a power house in Victoria Park, also the approval of the commissioners of Victoria Park.

NEW ENGLAND NOTES.

Boston, Mass., Dec. 16, 1899.

MESSRS. SMITH, WALLACE & BONTA, electrical and railway supply dealers, have removed their business to Woburn, Mass. This enables the firm to have its foundry, machine shop, store and office all together, and with a large addition of new machinery and increased space puts it in a position to execute orders with increased promptness. Both the machine shop and foundry departments are equipped with modern tools and appliances.

FREE SCIENTIFIC LECTURE COURSES.—The trustees of the Lowell Institute maintains under the auspices of the Massachusetts Institute of Technology, Boston, 20 free courses of lectures. These courses cover a wide range of subjects in pure and applied science as well as in literature. The programme of these courses for the season 1899-1900 includes the following: Electrical Measuring Instruments, 12 lectures by Assistant Professor F. A. Laws, on Tuesdays and Thursdays, beginning Nov. 7. Modern Methods of Electric Transmission of Power (illustrated by working models), 12 lectures by Assistant Professor William L. Puffer, on Tuesdays and Thursdays, beginning Dec. 21.

PENNSYLVANIA AND OHIO NOTES.

Pittsburg, Pa., Dec. 16, 1899.

THE MANUFACTURERS' LIGHT & HEAT COMPANY, of this city, has declared a monthly dividend of 1 per cent., payable on the 20th inst. Hereafter the company will declare quarterly dividends.

MR. F. H. WARD, former owner and manager of the Novelty Electrical Supply Company, of Wilkesbarre, Pa., has been appointed manager of the Electrical Contracting & Repairing Company of the same city.

THE LACKAWANNA MINING COMPANY, of Scranton, Pa., is now equipping the Dodge mine with electrical apparatus. They will run their mining cars by electric motors and also illuminate the mine electrically.

THE ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA will hold a meeting on Tuesday evening, Dec. 20, to discuss Mr. W. E. Snyder's paper, entitled "Mechanical Devices as Applied to Firing Steam Boilers."

THE FEDERAL TELEPHONE COMPANY has purchased the McKeesport Telephone Company. The price is said to have been $75,000. The officers of the McKeesport Company were: W. B. Peters, president; E. H. Pitts, secretary and treasurer; Dr. J. M. Thome, vice-president.

THE CONSOLIDATED TRACTION RELIEF ASSOCIATION, an organization composed of the members and employees of the Consolidated Traction Company of this city, held its annual meeting yesterday and elected the following officers; C. L. Magee, president; J. S. Ayers, vice-president; W. G. Gish, secretary; R. M. Hamilton, financial secretary.

CITY LIGHT.—The contract of the city of Pittsburg and the Allegheny County Light Company for lighting the city streets will expire shortly, and a new contract will have to be made. The city now uses about 1500 arc lights. Whenever the time for the renewal of this contract arrives an agitation starts for the city to erect its own electric plant, and there is again the same discussion on foot.

INCREASING TELEPHONE CAPITAL.—A special meeting has been called by the directors of the local telephone company, known as the Central District & Printing Telegraph Company, for the purpose of voting on a proposed increase of the capital stock from $4,000,000 to $7,500,000. This increase is to be used for improving the company's lines, $2,000,000 to be used in the city of Pittsburg alone. The company has at present 30,000 subscribers in this district, and the number is constantly growing.

THE STANDARD UNDERGROUND CABLE COMPANY, of this city, naturally feels jubilant over the award to it by the National Export Exposition,

held in Philadelphia last month, of a silver medal, a diploma and "the Blue Ribbon." The award was made for "the most complete exhibit ever made" of submarine cables, telephone cables, power cables, both for alternating and direct current; high pressure and low pressure cables, street railway cables and high grade rubber insulated wires, and the completeness of its working models, showing the detail of the accessories for connecting up and operating the same.

Cincinnati, Ohio, Dec. 16, 1899.

PRESIDENT LUKE LILLEY, of the Devere Electric Company, is in New York City, bidding on an important piece of work and incidentally laying in some material.

MR. JANTZ, of Jantz & Leist, says his company is just completing some large contracts for motors and generators, some of which will go to New York. Mr. Jantz contents himself with sticking closely to business and letting results speak for themselves.

MR. J. S. MONROE, manufacturers' agent, representing R. D. Nuttall & Co., the Ansonia Electric Company and two or three other prominent concerns, reports a good demand for finished brass and electric equipment, with prices well sustained and unchanged for the past 30 days.

MR. J. C. HOBART, secretary and general manager of the Triumph Electric Company, returned the first of the week from an extended eastern business trip. Business at this establishment is so far not at all affected by the holiday season, and the company has all the business it can handle, working overtime.

THE DEVERE ELECTRIC COMPANY is finishing the wiring for the new Union depot in Dayton, one of the biggest contracts of this character in the state at the present time. The same company is putting in a complete electric plant for Nivison & Weiskopf, glass manufacturers, at Reading, Ohio. The Standard Electrical Company is supplying the material for the new station at Dayton.

SPRINGFIELD ELECTRIC PROPERTIES ABSORBED.—Word comes from Springfield that the American Railways Company, the New Jersey corporation capitalized at $25,000,000, has acquired the Springfield street railway and the Springfield Light & Power Company's plant. The People's Street Railway, of Dayton, is also a late acquisition and negotiations are under way for the absorption of the Dayton, Springfield & Urbana electric road, which is practically completed between Springfield and Dayton.

Cleveland, Ohio, Dec. 16, 1899.

A NEW COMPANY, headed by General Warner, of Marietta, has bought up the franchise and right of way granted to the Columbus & Buckeye Lake Electric Railway and will push the enterprise to completion.

THE MAHONING VALLEY & SOUTHEASTERN ELECTRIC RAILWAY COMPANY has been granted a franchise by the county commissioners at Youngstown to extend its line from Struthers to Lowellville. This will connect Warren with the latter town.

THE FREMONT HOME TELEPHONE COMPANY, of Fremont, installed some time ago by an Elyria company, has changed hands. Local capitalists have formed a company, with Judge Brinkerhoff, president; John M. Sherman, treasurer, and R. J. Christy, secretary. The subscribers number 300.

MR. T. F. CALLAGHAN, superintendent of construction on the Cleveland & Eastern Electric Railway, was instantly killed at Chardon on the company's line last Saturday morning, by being crushed between two cars. Mr. Callaghan was formerly from Grand Rapids, Mich., where he is well known in electrical circles.

THE PUTNAM TELEPHONE COMPANY, of Ottawa, Ohio, has been incorporated with a capital of $40,000. The company has bought the system of the Ohio Telephone Company, operating in the central portion of the state, the principal lines in Paulding and Henry counties and the toll lines of Hixon, Wollam and Leipsic. It will serve over 60 villages and own about 300 miles of toll lines.

THE MORROW COUNTY ILLUMINATING COMPANY, with its principal offices in Cleveland, was incorporated last Wednesday with a capital stock of $25,000. A branch office will be established at Mt. Gilead, and the company will furnish electric lighting power at that point. The incorporators were: E. W. Radder, George W. Cleveland, George R. McKay, N. C. Whipple and M. Fisher, of Cleveland.

MUNICIPAL LIGHT IN CLEVELAND.—A committee appointed by the city council of Cleveland to consider the advisability of establishing a municipal electric lighting plant will undoubtedly report in favor of the plan. At present the city is paying $240,000 per year for lighting of all kinds, and it is claimed that a satisfactory lighting plant could be erected for about $2,500,000, which would be an excellent investment.

THE TOLEDO TRACTION COMPANY, of Toledo, is preparing to build an extensive addition to its power house. President A. E. Lang announces that his company is preparing to place orders for a large direct connected railway unit for delivery during the winter; also two 500-kw three-wire machines and one 500-kw alternator. Two batteries of boilers will also probably be required. The contracts for this equipment have not been closed.

TELEPHONE INJUNCTION.—The Miami County officials have entered suit against the United States Telephone Company to prevent it from erecting poles and stringing wires within the limits of the county. A temporary restraining order has been granted. The company is endeavoring to build a toll line from Toledo to Cincinnati. The Central Union Telephone Company holds franchises on all the pikes and roads in Miami County and in most instances the franchises are exclusive.

IMPROVING TOLEDO'S TELEPHONE SERVICE.—The Bell Telephone Company, at Toledo, is making extensive improvements in its equipment. Every telephone in the city will be replaced with the improved instrument and a new multiple switchboard will be installed. The new switchboard will have a capacity of 3500 numbers. Division Superintendent Greene, at Toledo, denies the report that the Bell Company has bought the controlling interest in the Harrison system in that city.

LIGHTING CONTRACT CLOSED IN TOLEDO.—Last Monday the city council of Toledo closed a five years' contract with the Toledo Consolidated Electric Company, to furnish light for the city at the rate of $83 per year per light. The Arbuckle-Ryan Company made a proposition at the same time to furnish the city with light at the rate of $83 per year per light, agreeing to turn the entire plant in first class condition over to the city, free of charge, at the end of 10 years. The proposition was presented by Mayor Jones, but he was not allowed to read it.

A NEW ELECTRIC RAILWAY.—A syndicate of Canton capitalists is endeavoring to enlist the aid of Cleveland capitalists to build an electric road from Canton to Akron, connecting at that point with the Akron, Bedford & Cleveland Electric Railway. H. A. Everett, president of the latter company, stated a few days ago that he had had a conference with the Canton people and he had verbally agreed to enter into a working arrangement whereby the cars of the new line would run into Cleveland over the Akron, Bedford & Cleveland Road. It is probable that the line will be built.

UNION TROLLEY STATION.—The suburban electric railway lines running into Cleveland have practically decided to erect a union passenger and freight station in the down town section of the city, so that all cars will start from the one central point. It is believed that the project will grealy increase the patronage of the lines, as many people object to waiting for cars on the down town street corners, especially during bad weather. The project will also settle the much discussed question of the justice of allowing the suburban cars to unload their freight and baggage on the public streets.

THE CLEVELAND, OHIO CENTRAL & CINCINNATI ELECTRIC RAILWAY COMPANY was incorporated last Monday with a capital stock of $10,000 by F. G. McAuley, Allen Greeley, G. A. Carlin, E. W. McFadden, J. F. Britton, W. E. Salen, W. S. Zehner, E. G. Meyer, B. Meyers, J. C. Clark, F. L. Berry, N. W. Zimmerman, F. W. Slatsman and D. W. Garver. The incorporation papers empower the company to build an electric line from Cleveland to Cincinnati, to be operated by steam or electricity, and to carry passengers, freight, express goods and United States mail. The headquarters of the company are at West Salem.

IMPROVED SUBURBAN SERVICE.—The suburban electric roads radiating from Cleveland are figuring on some extensive improvements. One of them is to double track the entire system and run cars on a 15-minute schedule instead of every hour or half-hour as at present. The traffic on all the roads is increasing so rapidly that faster time is demanded. Several of the suburban roads are having some difficulty with the city roads over their traffic arrangements, and it was stated by a prominent official a few days ago that unless a more satisfactory arrangement could be made at least two of the suburban roads would apply to the city for franchises on streets not now occupied, thus entering the city over their own tracks.

WESTERN NOTES.

Chicago, Ill., Dec. 16, 1899.

THE KELLOGG SWITCHBOARD & SUPPLY COMPANY has increased its capital stock from $250,000 to $500,000.

MR. JACOB LOOMIS, of the Lea Manufacturing Company, Elwood, Ind., well known throughout the electrical field, was in Chicago during the week.

FIRE IN AN ELECTRIC LIGHT PLANT.—Fire a few days ago damaged the plant of the Evanston Electric Illuminating Company at Evanston to the extent of $15,000 or $20,000. The loss is fully insured.

THE KARAS ELECTRIC MANUFACTURING COMPANY has been organized in this city to do a general manufacturing business. The capital stock is $15,000. The incorporators of the company are Joseph Karas, V. T. Kissinger and R. Buhrke.

THE CHICAGO ELECTRICAL ASSOCIATION will hold its next meeting on Friday evening, Jan. 5, 1900. Mr. H. R. King, of the engineering department of the Western Electric Company, will read a paper, entitled "The Modern Construction of Dynamo Electrical Machinery."

THE CHICAGO UNION TRACTION COMPANY has declared a dividend of 1¼ per cent. on the preferred stock, payable Jan. 20. Books close Dec. 21. Four directors have been added to the Board of the Chicago Union Traction Company—William Dickinson and J. V. Clarke, of Chicago, and Henry B. Hollins and Walter F. Johnson, of New York.

MR. ISAACS, manager of K. McLennan & Co., states that the past year has been a very prosperous one. The use of their commutator compound, he says, is almost general, and still continues to be regarded as a staple article and a necessary adjunct to every dynamo room. The greatest gain, however, has been in the foreign trade, which has so increased that there is scarcely a civilized country in which this compound is not now in use.

ELECTRIC RAILWAY DEVELOPMENT IN COLORADO.—It is reported from Denver, Colo., that Chicago capitalists have organized two companies to build an extensive system of electric railways throughout northern Colorado and furnish electric power to Denver. The companies are capitalized at $2,500,000 for the railway and $1,000,000 for power. The plant will be three-phase, with rotary converters at the Denver end, as well as substations along the line. Surveys are already completed, and the incorporators announce that they will have 62 miles of track laid by July next.

ELECTROLYSIS OF UNDERGROUND PIPES.—The law department of the city government is preparing an opinion as to the power of the city to force street railway companies to provide their rails with proper connection to prevent leakage of electricity, and the subsequent damage to water and other pipes laid below the tracks. A burst in a water main was reported, and workmen found that a hole an inch in diameter had been eaten entirely through the pipe, while in other portions immediately about the leak the pipe was al-

most as badly eaten away. The leak was 9 feet below the surface of the ground, immediately under a street car line. In another street an 18-inch main burst, and when excavation was made, it was found that a large hole had been eaten through the iron. This main was also 9 feet below the street car tracks. The city electrician has had trouble with electrolytic action on conduits for electric light and telephone wires, and on several occasions has been obliged to tear up conduits that are practically newly laid.

Milwaukee, Wis., Dec. 16, 1899.

THE AMERICAN WIRELESS TELEGRAPH COMPANY, with a capital of $1,000,000, will soon be organized in Milwaukee to own and operate the patent rights of the wireless telegraph instruments invented by W. S. Johnson and Charles E. Fortier, of this city. The company will have its headquarters and factories in Milwaukee.

Indianapolis, Ind., Dec. 16, 1899.

THE CENTRAL UNION GETS THE CONTRACTS.—The board of public safety has made a contract with the Central Union Telephone Company for 51 telephones and 100 patrol box instruments for the year 1900 at a total cost of $1391.

FRANCHISE UNANIMOUSLY VOTED DOWN.—The city council of Shelbyville, on Dec. 6, defeated by a unanimous vote the ordinance granting a franchise for an electric line in that city to be used in conjunction with a line running to Indianapolis.

ELECTRIC CAR LINE EXTENSION ASKED.—The citizens of Woodside, an eastern suburb, and the citizens of Cerealinetown, a western suburb of Indianapolis, have asked the board of public works to order the Indianapolis street railway to change and extend its lines, so as to provide service to the inhabitants of these communities.

THE ADVANCE ELECTRICAL COMPANY, of Indianapolis, was incorporated in 1896 and during the three years has extended its operations all over the country. The officers are: H. B. Marsh, president and general manager; C. H. Talmage, treasurer and manager of office business, and H. S. Wood, secretary. These men, with J. G. Ingram, form the board of directors.

THE SANBURN ELECTRIC COMPANY, of Indianapolis, is a leading concern in the line of fitting office buildings, factories, stores and residences with electric lights and electrical appliances. The company's work and contracts have been extensive throughout the country, it having installed some very elaborate systems in public buildings. G. M. and A. W. Sanburn are the principal officers of the company.

OLD WABASH & ERIE CANAL PURCHASED.—A. N. Dukes, of Peru, has purchased the old canal from Fort Wayne to Lagro. He and the Shirk heirs have owned the canal from Lagro to Lafayette for years, and now have the complete line, which will be used in the near future as a route for an interurban electric line. This right of way runs through the heart of the Wabash valley corn belt and the freight business will be enormous.

WORK ON ELECTRIC ROADS.—The work on the Indianapolis and Martinsville electric lines has been suspended until spring. The company is experiencing some difficulty in securing the necessary money to complete the enterprise, but the managers say it will be built next season. The grading on the Greenfield line is completed up to the terminal of the Irvington line. The track laying is progressing rapidly. The company has made arrangements with the Indianapolis company to enter the city over the Irvington line.

THE NORTHERN TRACTION COMPANY, composed of Anderson and Laporte persons, has a franchise from Laporte to Michigan City, but has been unable to sell bonds, and Jacob Madlem, of Goshen, who has the contract for the grading, says he will do nothing on the work until spring. The citizens of Laporte and Michigan City look to the Indiana Electric Railway Company as their only hope, and the present steps of the company toward interesting eastern capitalists are regarded as important and encouraging.

CONDITION OF NORTHERN INDIANA LINES.—The Indiana Electric Railway Company has ordered abstracts of title of all the corporation property in Elkhart and St. Joseph counties. It is the intention to issue bonds at once sufficient to pay the debt owing to J. J. Burns, the original owner of the Elkhart and Goshen City street car lines, of whom the present company bought the lines as a foundation for its present interurban system a year ago. The company proposes to proceed with the additional money raised by the bonds, to connect with Laporte and Michigan City from South Bend, the present western terminus of its lines.

MUNICIPAL OWNERSHIP AND OPERATION.—The City of Greenfield felicitates itself over the successful municipal operation of its electric light plant during the past year. The rate paid when the plant was under private ownership has been reduced and the rates are now low enough to be in the reach of all. In the city of Logansport the electric light plant was constructed in 1895 and the cost to date has been $108,000. Last year the cost of operation was $14,000, with an income of $33,000, leaving $19,000 in net earnings. There are more than 1200 consumers and 200 street lamps. The cost to private consumers is 5 cents per kilowatt.

THE JENNY ELECTRIC MANUFACTURING COMPANY, of this city, is one of the pioneers in the field, and has one of the most completely equipped factories in the country. In addition to a full line of standard generators, motors of various kinds, the company makes a line of specialties that have attracted wide attention, including an automatic system for controlling the speed of printing presses, and separate motors for typesetting machines. The products of this plant go all over the world; a large motor is now being erected for a Russian concern. The officers are: Charles D. Jenny, president; V. C. Kendall, treasurer, and John Wynn, secretary. The company is rushed with business and running the factory day and night.

REBELLION AGAINST HIGHER LIGHTING RATES.—The increase of rates by the Kokomo Electric Lighting Company, which took effect Dec. 1, has resulted in an open rebellion by the consumers in Kokomo. A number of public meetings have been held by the citizens for a united action in the resisting of the advance. The increase was from $4 a month to $5 for 2000-candle arcs, and from 25 cents to 40 cents a month for incandescents, a rate far in advance of the average Indiana cities, it is claimed. Steps are being taken to organize an independent commercial lighting company, this failing, a return to the use of gas for illumination is agreed upon. The electric company offered some concessions during the past week, but they were not accepted by the patrons.

THE STREET RAILWAY INVESTIGATION.—The Marion County grand jury has examined over 100 witnesses relative to the alleged bribery of councilmen who voted to grant the Indianapolis Street Railway Company its present 34-year charter. Bank cashiers testified during the week to certain amounts deposited by councilmen during this time, and the county recorder testified and furnished record evidence of certain councilmen having paid off mortgages soon after the franchise was voted. The last witness examined was General Manager McGowan. He is supposed to have been asked what disposition he made of a large sum of money which was on deposit in a local bank and drawn out by him at the time. Mr. McGowan said before entering the room that it was not wise for a man called by the grand jury to talk about what he would testify to, in advance of the inquiry.

St. Louis, Mo., Dec. 16, 1899.

MR. HERBERT A. WAGNER, general superintendent of the Missouri-Edison Electric Company, will resign on Jan. 1 to become the president of the Mississippi Valley Automobile Transportation Company, which will have automobile vehicles and cabs in operation in St. Louis within a month.

FRANCHISE ASKED FOR.—J. D. Houseman, of St. Louis, is asking for a franchise for a street railway in St. Charles, St. Louis County. It is stated that $100,000 have been subscribed for the electric railway; that three miles of the road are now in operation in St. Louis County, and that a large power house has been built.

CARRYING FREIGHT A MISDEMEANOR.—The mayor of Kirkwood has approved the ordinance passed by the board of aldermen, making it a misdemeanor for the St. Louis & Meramec River Railway to haul freight, baggage, express or mail through the town and the marshal has been notified to arrest conductors and motormen and the manager of the road if the ordinance is violated.

SUIT TO SET ASIDE STREET RAILWAY CONSOLIDATION.—Minority stockholders in the Lindell Railway Company filed suit Dec. 13 to set aside the deed by which that company's property was conveyed to the United Railways Company. The action was brought by Charles J. Tanner and Max Judd. The defendants are the Lindell Railway Company, the United Railways Company, the St. Louis Trust Company, Edwards Whitaker, Henry C. Hoarstick, Charles D. McClure, S. M. Dodd and William Duncan.

THE LIGHTING CONTRACTS.—The desire of the National Subway Com the company has changed hands has given rise to the conclusion that the new company will be a factor in the competition for the coming city lighting contract. It looks to people interested that the National Subway Company and the Imperial Electric Light, Heat & Power Company were now under the same management. It is said five companies are now able to fulfil the lighting contracts, viz.: The Missouri-Edison, the Imperial, the Citizens', the Edison Illuminating Company of Carondelet and the Laclede Gaslight Company. All have property rights in the conduits and with the exception of the Citizens' all have power plants.

San Francisco, Cal., Dec. 10, 1899.

SCIO, LINN COUNTY, Ore., now has a complete telephone exchange in operation.

SUMPTER, OREGON, which is enjoying a mining boom, is having its electric lighting plant enlarged.

HATTIE HYDE ADDISON, wife of Dr. Thomas Addison, died at the family residence, in Berkeley, Cal., on Nov. 29.

THE PACIFIC AUXILIARY FIRE ALARM COMPANY, San Francisco, has declared an extra dividend of 5 cents per share on the capital stock, payable on and after Dec. 14, 1899.

MR. W. H. BURGHARDT, president of the Oregon City Southern Railway Company, recently returned from the eastern states. While at the east he was assured that funds would be supplied with which to complete the Oregon road.

THE BELMONT LIGHT & POWER COMPANY was recently incorporated with a capital stock of $100,000. The directors named are C. R. Splivale, C. E. Dugan, W. A. Ament, George C. Ross, of Belmont, Cal., and N. T. Smith, of San Carlos.

MAYOR PHELAN has recommended that the compromise lighting rate, under which San Francisco's public lighting bills have been paid for several months past, be continued in force until next July, which is the regular time of advertising for proposals for city lighting.

THE SAN JOSE & ALVISO RAILROAD COMPANY was recently incorporated. The directors are Hugh Center, A. Greeninger, H. L. Miller, C. M. Hatcher, V. Koch and G. W. Lowery, of San Jose, and E. L. Reese, of San Francisco. Capital stock, $200,000; subscribed, $102,250.

MECHANICAL DRAFT EQUIPMENT.—One of the features of the new power plant of the Independent Electric Light & Power Company, of San Francisco, is a complete mechanical draft equipment, consisting of four fans arranged to operate upon the induced principle. These fans are arranged in pairs, each fan being 10 feet in diameter, and provided with an independent 8 by 12 horizontal engine, direct connected. This apparatus is being furnished by the B. F. Sturtevant Company, of Boston, Mass.

THE PACIFIC TELEPHONE & TELEGRAPH COMPANY, San Francisco, recently made representations to the board of supervisors to the effect

that the proposed enforcement of the slot-machine ordinance upon slot-telephones would be unjust. The company claims that its rates are much lower than those charged for corresponding service in the eastern states. It has been proposed to exact a license of $1 per quarter for each telephone having a slot attachment. An increase in rates will be the probable effect if the ordinance be enforced.

A FRANCHISE has been formally applied for in Portland, Ore., for the construction, etc., of an electric street railway line along the proposed extension of Corbett Road, beginning at its intersection with Hamilton Avenue. The line would follow a number of streets and roads to Fulton Park. This would take the place of the present electric line from Hamilton Avenue to Fulton Park, which is expensive to operate and requires the maintenance of long bridges, which are rapidly deteriorating. The ordinance has been referred to the street committee.

THE SACRAMENTO & SAN JOAQUIN VALLEY RAILROAD COMPANY, which was recently incorporated with a capitalization of $500,000, is composed, largely, of Los Angeles capitalists. They propose to build a road between Sacramento and Stockton, Cal., touching at New Hope. There will be a branch from the town of Franklin to the Sacramento River. The directors are John Cross, Arthur Newton, Warren Gillelen, A. A. Cross and John A. Payne, all of Los Angeles; J. S. Hanford, of St. Louis, Mo., and Arthur Thornton, of New Hope.

TELEGRAMS TO ALASKA AND THE FAR NORTH.—The Postal Telegraph Company is now accepting telegrams to a number of points in Alaska and British territory in the far north. The messages are transmitted by telegraph to Seattle, Wash., Vancouver or Victoria, B. C., forwarded by the first steamer to Skagway, Alaska, and thence wired over the government telegraph lines to their destinations. Messages are accepted for the following points: Glacier, Log Cabin, Middle Lake, Shops, Skagway, Summit, Alaska; Bennett, B. C.; Caribou Crossing, Dawson City, Five Fingers, Fort Selkirk, Hootalinqua, Lower Le Barge, Miles Canyon, Tagish, White Horse, N. W. T.

CANADIAN NOTES.

Ottawa, Ont., Dec. 16, 1899.

FOUNDING A RESEARCH SCHOLARSHIP AT McGILL.—Dean Bovey, of the faculty of applied science at McGill University, Montreal, has received word from Prof. Owens, who is at present in New York, conveying the information that a friend of his had given $10,000 to found a research scholarship at McGill in electric engineering.

ELECTRIC LOCOMOTIVE.—The second electrically driven locomotive in Canada has just been put in service on the Metropolitan Railway, Toronto, Ont. The locomotive was manufactured at the Baldwin works, Philadelphia, Pa., and weighs, when completely equipped, nearly 50 tons. The pulling power of each engine is fully equal to a large mogul engine, and a guarantee accompanies it that it is capable of drawing a 30-ton car up a 9 per cent. grade.

THE CANADIAN GENERAL ELECTRIC COMPANY has received an order from the Trenton Electric Company, of Trenton, Ont., for a 75-light equipment of alternating series enclosed arc lamps, with automatic regulating transformers and switchboards. These are to be used for street lighting in Belleville, Ont., the current being taken from the three-phase transmission lines coming from Trenton, a distance of 13 miles. This is the third installation of the kind in Canada.

THE ELECTRICAL MAINTENANCE & CONSTRUCTION COMPANY, of Toronto, which began business less than a year ago, has had a remarkably successful career at the start, having expanded until it has now contracts in hand largely aggregating over $100,000. In view of the development of its business it has been found necessary to increase the capital stock from $20,000 to $250,000. One of the contracts this company has in hand is the construction of the extensive Orillia power plant.

A LARGE DYNAMO.—The biggest dynamo in Canada will be that in the new power house of the Ottawa Electric Company, of Ottawa. It will weigh 107 tons, stand 18 feet high and develop 1700-hp. It will have sufficient capacity to supply the whole electric car system in Ottawa. This huge dynamo was constructed at the Westinghouse shops in Pittsburg, Pa., and cost about $40,000. It will be direct connected to turbines. These turbine water wheels, six in number, revolving on one horizontal shaft, are calculated to develop 2000-hp The plant now in use will be held in reserve.

DIVIDEND.—At a meeting of the directors of the Canadian General Electric Co., of Montreal, vacancies on the board were filled by the election of Sir Wm. C. Van Horne and Herbert S. Holt, president of the Montreal Gas Co., as directors. At this meeting also the usual dividend of 3 per cent. for the half year was declared on the preference stock A dividend of 4 per cent. for the half year, together with a bonus of 2 per cent also was declared on the common stock, making a total of 10 per cent. on the common stock of the company for the year.

THE CANADIAN ELECTRIC LIGHT COMPANY, of Quebec, is getting extensive work done at Chaudiere Falls, eight miles west of Levis, Quebec, on the Chaudiere River. The Engineering Contract Company, which has the contract to put up the dam and the power house, has had a large force of men at work since the end of August last, and it is expected that everything will be completed early next spring. The Canadian Electric Light Company will then be in a position to supply light and power to consumers. The city council of Levis will very likely use electric power for its contemplated water works, and the city will also be lighted by electricity. There are also good prospects of a company being former to build and operate an electric railway between St. Romauld and St. Joseph de Levis.

NEW INDUSTRIES IN HAMILTON.—The National Cycle & Automobile Company, with a capital of $2,500,000, has secured temporary premises in the city of Hamilton, Ont., and will build its factory there at once. This company has selected the city of Hamilton in preference to Toronto, where it was at first proposed to establish its works, on account of the cheapness of the electrical power which is now obtainable in the former city. Thus, by being able to furnish cheap electric power, Hamilton is outbidding the larger city of Toronto in securing industrial concerns. Two other smaller factories, each employing 400 hands, are also negotiating with the Hamilton authorities for sites in that city. The cheap electric power furnished by the Cataract Power Company, is the all-important factor in these negotiations and is the drawing card for Hamilton. It cost the Cataract Power Company $500,000 to develop its power, which is produced at Decew's Falls, nearly 40 miles from the city, and transmitted at additional cost over copper cables to Hamilton. It is also stated that some Boston (Mass.) basket manufacturers, in consideration of being able to obtain this power on so cheap a scale for manufacturing purposes, have been interviewing local fruit growers with a view to establishing a basket factory in Hamilton.

General News.

THE TELEGRAPH AND TELEPHONE.

MORAVIA, IOWA.—The Moravia Telephone Company has been incorporated. Capital, $10,000. Incorporators, E. McFatridge, C. M. McFatridge, both of Moravia.

FALL RIVER, MASS.—The Fall River Automatic Telephone Company has been incorporated. Capital, $135,000. Incorporators, R. T. Davis, B. D. Davel, G. A. Chase.

ST. MARYS, W. VA.—The St. Marys & Union Mills Telephone Company has been incorporated. Capital, $2000. Incorporators, G. C. Roby, G. K. Roby, A. W. Powell, M. F. Shingleton, C. P. Craig, all of St. Marys.

HARRISBURG, PA.—The Slate Belt Telephone Company has been organized in Slatington. Capital, $10,000. Incorporators, J. D. Zellner, W. H. Gish, A. J. Kern, all of Slatington; F. Jacobs, F. H. Trexler, of Allentown.

DOVER, DEL.—The Interstate Telephone & Telegraph Company has been incorporated here. Capital, $2,000,000. Incorporators, J. C. Landes, of Norristown, Pa.; T. Dougherty, of Allentown; A. M. Worstall, of Philadelphia, Pa.

BURNSVILLE, W. VA.—The Weston Central Telephone Company has been incorporated here. Capital, $100,000. Incorporators, H. Ames, J. B. Yoak, F. S. Greathouse, F. H. Kidd, all of Burnsville; J. I. Bender, of Gem; M. W. Hefner, of Burnsville.

WILMINGTON, DEL.—The United Telephone & Telegraph Company, which recently secured control of the Delmarvia Telephone Company, has absorbed the Maryland Telephone & Telegraph Company, of Baltimore, and the Pittsburg & Allegheny Telephone & Telegraph Company, of Pittsburg.

NEW YORK, N. Y.—The General Telephone & Electric Company, of New York City, has been incorporated to manufacture electric, magnetic and telephonic appliances. Capital, $10,000. Directors, Richard C. Weithas, Brooklyn; J. M. Dunscomb, Frank M. Holahan, and W. H. Carr, New York City.

COLUMBUS, NEB.—A big telephone war is waging at Fairbury between the Nebraska Telephone Company and a local company recently organized. The new company advertised a rate for service of $1.50 per month. The Nebraska Telephone Company has cut its rate, which was formerly $3, to 50 cents per month.

HERKIMER, N. Y.—The County Telephone Company, of Herkimer, has been incorporated to operate in and between Herkimer, Mohawk, Ilion, Frankfort and other places. Capital, $75,000. Directors, E. J. Berber, C. James, S. Braidley, Jr., Wauseon, Ohio; James H. Becker, Clyde, Ohio; William J. Taber, Herkimer; George H. Tuttle, Mohawk, and James Conkling and G. G. Halles, Ilion.

WATERBURY, CONN.—The aldermen have accepted the conditions of the Waterbury Automatic Telephone Company for stringing its wires in this city. It is provided that the company shall provide 20 instruments for the use of the city departments, five more at the end of five years, and five at the end of 10. There has been a warm fight over this new enterprise, the Southern New England people naturally objecting to competition.

JERSEY CITY, N. J.—The control of the Hudson Telephone Company, which has headquarters in Jersey City, has passed to Colonel J. B. Curtis, of New York. It is believed that he represents the Bell Telephone Company. The change was effected by the election to the board of directors of Clement J. Walker, Edward W. Jones and Augustus Woodruff, all of New York. They succeed William H. Peckham, C. J. Cronan and Oscar Kreig, who resigned.

TRENTON, N. J.—The Seashore & Delaware River Telephone, Telegraph & Cable Company has been incorporated here. The company is controlled by the Telephone, Telegraph & Cable Company of America, and is capitalized at $100,000. It will build a telephone line through Jersey City, Bayonne and Elizabeth, and along the Atlantic Coast to Atlantic City and Cape May, and thence to Camden. The incorporators are James P. Hayes, Camden; George W. Beers, Fort Wayne, Ind., and John B. Stauffer, Philadelphia.

WILKESBARRE, PA.—The projectors of the independent telephone companies in Wilkesbarre, Hazleton, Allentown, Lebanon, Carlisle, Columbia, Lancaster, Norristown and York have applied for a charter for the purpose of establishing a long distance service. The proposed corporation will be called the Interstate Telegraph & Telephone Company, and the capital is to be $2,000,000. The projectors say that less than 50 miles of new lines will connect all the independent companies between Philadelphia and Canton, Ohio, into a very respectable long distance system.

ELECTRIC LIGHT AND POWER.

SPRINGFIELD, OHIO.—The American Railway Company, of Philadelphia, has bought the plant of the Springfield Light & Power Company.

BASIC CITY, VA.—Electric lighting is to be installed in this place. Mr. J. M. Hoge, of Staunton, Va., is in the market for a 1000-light alternator, wire, etc.

ALBANY, N. Y.—The Halfmoon Light, Heat & Power Company has certified to the secretary of state that it had increased its capital stock from $20,000 to $50,000.

COEYMANS, N. Y.—At a meeting of the town board of Coeymans a franchise was granted to M. F. Inman & Co., of New York, to furnish electric power for the lighting of Coeymans and Ravena.

PHILADELPHIA, PA.—The Seacoast Electric Light Company, of Five Mile Beach, has been reorganized, and arrangements will soon be made for the lighting of the resorts of Wildwood and Holly Beach.

COLUMBUS, OHIO.—The Mahoning Valley Light, Heat & Power Company has been organized in Youngstown. Capital, $100,000. Incorporators, A. Anderson, J. E. McVey, D. F. Griffith, A. L. Rowland, F. P. Hood.

PHILADELPHIA, PA.—The Hudson Valley Electric Company, of Philadelphia, Pa., has been incorporated. Capital, $400,000. Incorporators, H. D. Long, E. A. Lyon, C. E. Lent, G. S. Wertsner, A. A. Sparks, all of Philadelphia, Pa.

NEW BRUNSWICK, N. J.—The New Brunswick Light, Heat & Power Company has been incorporated. Capital, $500,000. Incorporators, Bernard Katz, Paterson, N. J.; Adolph A. Eisele, William O. Kuebler, of Newark, N. J.

NORFOLK, VA.—The Norfolk Heat, Light & Power Company has been incorporated; capital, $300,000. Incorporators: G. M. Bunting, of Chester; H. B. Hodge, H. P. Keen, J. H. Davis, all of Philadelphia, Pa.; W. D. Pender, D. Pender, both of Norfolk.

WINSTON, N. C.—The Fries Manufacturing & Power Company, of Winston-Salem, is contemplaing the extension of its lighting system. It will also add a gas and an ice plant. Messrs. J. G. White & Co., 29 Broadway, New York, have the improvements in charge.

PHILADELPHIA, PA.—The United Light & Power Company has been incorporated in this city. Capital, $5,000,000. Incorporators, L. E. White, of New York City; C. G. Blandy, of Newark, Del.; W. E. Lockwood, Jr., P. A. Warne, T. F. Daly, all of Philadelphia, Pa.

COLD SPRING, N. Y.—The Cold Spring Light, Heat & Power Company was recently incorporated with a capital stock of $20,000. The company has secured the contract to light the village with 67 arc lights, besides 730 incandescents. Mr. George F. Brockman is the general manager.

ESSEX FELLS, N. J.—The Essex Fells Electric Light & Water Company has been incorporated to furnish electricity for light, etc. Capital, $10,000. Incorporators: Herman Wendell, Frederick H. Treat, of Wayne, Delaware County, Pa.; Charles O. A. Maule, Essex Fells, Essex County, N. J.

TALLAHASSEE, FLA.—The Tampa Electric Company has been incorporated with a capital of $500,000. The company is organized for the purpose of furnishing light, heat, power for railways and other purposes. The incorporators are George J. Baldwin, Peter O. Knight, Eliot Wadsworth, W. H. Blood, Jr., and H. G. Bradlee.

FREDERICKSBURG, VA.—Judge A. W. Wallace, of the corporation court, has confirmed the sale of the Rappahannock Light & Power Company's property, franchises, etc., here. The amount paid is $2,227.50, and the purchaser is Mr. Charles R. Sickles, of New York. This is the electric light plant that has for some years lighted the streets of Fredericksburg.

BIDDEFORD, ME.—The electric lighting plant in Biddeford of the York Light & Heat Co., which lights Saco and part of Biddeford, was recently destroyed by the explosion of the boiler. The explosion completely wrecked the building and destroyed every piece of machinery. The building was worth $2500 and the machinery was worth probably from $12,000 to $15,000, and is insured.

VICTOR, COL.—The La Belle Electric & Power Company has placed orders for new machinery, which will increase the capacity of its electric light and power plant 33⅓ per cent. The new machinery ordered consists of a 1000-hp generator and a 1000-hp engine. Before the big plant was completed it was evident that its capacity was inadequate for the demands for power, and now, but a few months after it has started up, new machinery has had to be ordered.

CEDAR RAPIDS, IA.—The Cedar Rapids Electric Light & Power Company has been reorganized, all the stock having been purchased by Cedar Rapids capitalists, and all the bonds, which have been held in the east, also having been secured by the new stockholders. C. J. Ives is the president of the new company, and J. H. Smith is vice-president, his son being secretary and treasurer. The new company will purchase a large amount of machinery and double the capacity of the plant.

THE ELECTRIC RAILWAY.

GUTHRIE, OKLA.—The Guthrie city council has granted a franchise to a New York syndicate to construct and operate an electric railway system here for a period of 40 years. The council required a forfeit of $500 from the company to commence within a year.

GARDNER, ME.—At a joint meeting of the directors of the Gardner Street Railway Company and the Gardner, Westminster & Fitchburg Street Railway Company, it was unanimously voted to consolidate the two companies under the title of the Gardner, Westminster & Fitchburg Street Railway Company.

COLUMBUS, OHIO.—The Supreme Court overruled the motion for a perpetual injunction in the quo-warranto suit brought against the Toledo, Fremont & Norwalk Railway Company to stop the construction of an electric road on the Western Reserve and Maumee Turnpike. It was contended that county commissioners have no right to grant franchises to electric roads on public highways. The decision affirms the right of the commissioners to grant such franchises.

SPOKANE, WASH.—Ex-Senator Warner Miller, of New York, and James F. McNaught, of Seattle, have taken an option on the water power at Kettle Falls on the Columbia, north of Spokane, and contemplate the building of an electric railroad from the Spokane Falls & Northern Railroad to Republic Camp.

SARATOGA, N. Y.—The Saratoga Traction Company has been authorized by the state railroad commission to mortgage its property in the sum of $300,000 to make improvements and pay off a former mortgage. The commission has also granted permission to the Raquette Lake Railway Company to issue $250,000 worth of bonds.

TRENTON, N. J.—The Murphy Safety Third Rail Electric Company has filed articles of incorporation; capital stock, $2,500,000. The incorporators are Matthias Plum, Alexander Beach and William M. Keepers, Newark, N. J.; Charles T. Hayman, of Cincinnati, and George H. Carey, John B. Renwick and Lauron Ingels, of New York.

LOUISVILLE, KY.—Rumors are being circulated here that steps are on foot looking to the consolidation of the New Orleans street railways. There are five or six systems in the Crescent City, though the New Orleans City Railway, which is largely owned here, is the biggest. New Orleans is the only large city in the country where the roads have not been combined.

QUINCY, MASS.—The carsheds of the Quincy & Boston Street Railway Company were destroyed by fire on Dec. 7. The loss was $60,000. Eighteen cars were destroyed. The winter service of the railroad company is badly crippled as the result of the fire, as all the cars burned were of the closed type, and, in addition, three snow plows and a construction car were destroyed. Each of these cars were valued at $3500 each. The rolling stock and buildings were fully insured.

EASTON, PA.—It is stated that the mammoth power plant about to be built along the Delaware River at Raubsville, five miles below Easton, is to supply electricity for running boats through the Delaware Canal from Easton to Trenton by a trolley wire. Boats are now being fitted up to be operated by electric power. The towpath is to be made a bed for a trolley road, which is to be used for the carrying of passengers and freight. The freight cars, however, are to be run only during the winter, when the canal is closed.

CHATTANOOGA, TENN.—Chicago capitalists, headed by J. C. Shaffer, inspected the local transportation lines with a view to the purchase of all the lines of the Chattanooga Electric Street Railroad, the Chattanooga North Side road, the Chattanooga Rapid Transit Line, now being built to Chickamauga Park; the two Lookout Mountain inclines, and Lookout Inn. The property represents at least $1,500,000. The same capitalists own the street railroad system at Vicksburg, Miss., and are negotiating for the purchase of systems in other southern cities.

ROCKVILLE CENTRE, L. I.—The village trustees granted the Nassau Belt Line Traction Company a franchise for 199 years. The road will run through about two miles of the village streets. The road must be in operation to Long Beach on or before July 1, 1900, and by Oct. 1 next the remaining portion in the village must be running. The route through this village is one of the links of a 30-mile route which the Nassau Belt Line Company proposes building to connect the village of the town of Hempstead, from Mineola on the north to Long Beach on the south.

ST. PAUL, MINN.—An electric railway is to be immediately constructed over the 40 miles between Seattle and Tacoma, and the fact that the road is to be equipped with heavy steel rails and steel bridges has given rise to the rumor that the Great Northern will buy up the electric line as soon as it is completed, and thus gain an entrance into Tacoma. The terms of the contract for constructing the line stipulate that the overhead wires shall be high enough to allow of the passage of locomotives and freight trains beneath. The Great Northern denies any such intentions as are claimed.

PENOBSCOT, ME.—President Beal, of the Penobscot Central Railroad Company, announces that next spring the trolley system will be introduced on the line, and that a branch will in all probability be constructed to Pushaw Pond. The present motive power of the road is known as the Patton electric motor system. President Beal says that while the Patton motor works all right, and is capable of doing all that is required of it, it is unknown to capitalists and as a result they refuse to invest in a road thus equipped. They are willing to invest in a trolley road, and for that reason he will make the change. The power house for the new system will be located at Kenduskeag, where there is a good water power and a dam already built. Mr. Beal expects to have the trolleys in operation by the first of June, 1900.

THE AUTOMOBILE.

THE WESTERN AUTOMOBILE COMPANY has been incorporated at Trenton, N. J., with a capital of $6,000,000, to manufacture automobiles and electric motor vehicles. The incorporators are H. M. Martin, A. H. Chetselain, John R. Curtis and David H. Roolin, all of Camden.

PERSONAL.

MR. W. J. JOHNSTON sailed Dec. 11 from Amoy for Formosa, where he will join a party which has been invited by the chief of one of the head-hunting tribes to pay him a visit in his mountain fastness.

MR. A. M. GREENE, JR., of the staff of the mechanical engineering department of the University of Pennsylvania, who has had charge of the mechanical installation at the National Export Exposition, has completed his work there.

MR. D. H. RICH, who for a long time has been doing electrical work for the Armour Packing Company, and later with the Trans-Mississippi and Greater America Expositions at Omaha, has been appointed superintendent of the Belt Light & Power Company, of Lead, South Dakota. Mr. Rich is a graduate of the State University of Nebraska.

MR. W. F. WHITE, on January 1, will become general manager of the Cincinnati Edison Electric Company, relieving Mr. John I. Beggs of the pressure of his duties there and allowing him to concentrate more time and

attention on the important work which the North American Company has entrusted to him in regard to all its electrical properties. Mr. White is a man well known in the electrical field.

OBITUARY.

JOHN H. VANDERVEER, superintendent of shops of the Brooklyn Rapid Transit Company, died at his home in Brooklyn on Dec. 3 of typhoid fever. He was born in Somerville, N. J., on March 28, 1864. Mr. Vanderveer read a paper at the recent convention in Chicago of the American Street Railway Association, entitled "The Care of Car Equipment," and it is said that his illness dated from that time.

LEGAL.

FREIGHT ON TROLLEY ROADS.—Judge Roraback, of the superior court, New Haven, Conn., has decided that under the general street railroad law of that state, municipalities have no power to prevent freight traffic on trolley roads, and that the question of determining the character of trolley traffic rests with the superior court.

Trade and Industrial Notes.

ENCLOSED ARC LAMPS.—The Electric Appliance Company, Chicago, has issued pamphlets describing the different styles of the Adams-Bagnall enclosed arc lamps.

RARITAN COPPER WORKS.—The extension of the furnace building of the Raritan Copper Works at Perth Amboy, N. J., will be furnished by the Berlin Iron Bridge Company, of East Berlin, Conn.

THE WILLIAMS-ABBOTT ELECTRIC COMPANY, Cleveland, Ohio, has recently made very marked improvements in its magneto bell and telephone arms. A copy of the company's Christmas illustrated circular will be forwarded to any address.

THE WESTERN ELECTRIC SUPPLY COMPANY, St. Louis, Mo., has issued a little pamphlet on the Perkins sockets, rheostats, receptacles and attachment plugs. These various articles are illustrated and the prices of the same are given.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, Chicago, is among the first in the electrical field to bring out a calendar for the new year. The calendar, which is intended to hang up, contains an interesting print of a woman.

MECHANICAL DRAFT.—A second edition of the lecture by Walter B. Snow, on "The Influence of Mechanical Draft Upon the Ultimate Efficiency of Steam Boilers," has just been issued by the B. F. Sturtevant Company, of Boston, Mass., by whom copies will be sent upon application.

A CANADIAN ELECTRICAL SUPPLY HOUSE.—The Ballard Electric & Machine Company, Limited, 6 Adelaide Street, West, Toronto, Ont., has issued an illustrated catalogue of general electrical supplies, in which it is a dealer. The company also does machine work and manufactures instruments.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, has recently added to its plant a new factory which has 30,000 feet of floor space. This factory is being equipped throughout with the most modern machinery and is to be used entirely for the building of direct-connected fans, motors and dynamos.

THE CENTRAL ELECTRIC COMPANY, Chicago, extends greeting to the trade with a Merry Christmas to all. It desires to state that a substantial token of esteem will be sent to its friends. This will be a specially compiled book of some 200 pages arranged for records and giving much useful information.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., is about to complete for the American Ordnance Company, of Bridgeport, Conn., a new machine shop with traveling cranes, runways, etc. The building will be covered with the Berlin Iron Bridge Company patent anti-condensation corrugated iron roof covering.

THE PORTER STANDARD MOTOR.—Messrs. Kendrick & Davis, Lebanon, N. H., have just issued a booklet on the Porter standard motors, of which they are the manufacturers. The various types and sizes of this machine are illustrated and briefly described. These are battery motors, but may be wound to run in series with a 16-cp lamp on 110-volt direct current circuits when desired.

THE STEWART ELECTRICAL COMPANY, Cincinnati, O., has a good stock of new and second-hand dynamos and motors for prompt delivery, also a large assortment of switches, meters, cut-outs, fuse blocks, brushes, etc. It has a well equipped shop for repair work, and it rewinds armatures and fields and refills commutators. The company's headquarters are at Fifth and Sycamore Streets, Cincinnati.

METAL POLISH.—Polished metal, like a polished man, is attractive and makes a good impression. The "U. S." Infallible Metal Polish Paste, manufactured by Mr. George William Hoffman, 295 East Washington Street, Indianapolis, Ind., is reputed to be one of the best metal polishes in the market. Mr. Hoffman states that the demand and use of this polish is constantly increasing, and that this has been a remarkably good year for the polish business.

THERMOSTATIC ALARM.—A firm of jewelers and silversmiths, of Attleboro, Mass., has addressed to George A. Wall, 101 Sabin Street, Providence, R. I., a handsome testimonial as to the merits of the White thermostatic automatic fire alarm used in combination with the Grinnell sprinkler. It is stated that eight fires have occurred in the factory, and in each case it was promptly discovered and put out by the alarm system, the loss being less than $340 in the eight cases. It is added that the system has never failed and has never given a false alarm.

AUTOMATIC TELEPHONE PAY STATIONS.—The Union Telegraph & Telephone Company, of Erie, Pa., after a year's experience with the automatic toll collecting device, manufactured by the Mason Telephone Pay Station Company, of Ludington, Mich., it is stated, has found it a very reliable apparatus and a profitable investment. The Union Company has just placed a large order with the Mason people for No. 1, three-slot automatic toll collecting machines, which will be used in its exchanges in the following named places: Erie, Pa.; Greenville, Pa.; Sharon, Pa.; Grove City, Pa.; New Castle, Pa.; Sandy Lake, Pa.; Wampum, Pa.; Moravia, Pa.; Warren, Pa.; Bradford, Pa., and Olean, N. Y. Many other independent companies are equipping their systems with the automatic machines in order to better compete with the Bell companies; among them might be mentioned those of Ft. Wayne and Indianapolis, Ind.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED DEC. 12, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

11,794. ELECTRIC SWITCH; J. E. Sales and H. E. Reeve, New York. App. filed Aug. 1, 1899. The base of the switch is of sheet metal struck up and having stiffening flanges and retaining lugs formed at the same operation. An insulating block is centred between the lugs and carries the contacts of the switch.

638,687. ELECTRIC SWITCH; J. M. Andersen, Boston, Mass. App. filed Dec. 23, 1897. This is a double throw quick brake switch, the devices for obtaining the quick action being applied at the pivot of the blades and operative in connection with either pair of clips.

638,692. MANHOLE FOR ELECTRIC CONDUITS; J. Banwell, Cleveland, Ohio. App. filed July 19, 1899. The box is made of two telescoping parts so that its depth may be made to suit the grade of the street; devices for holding the parts in any relative position is a feature of the invention.

638,697. TROLLEY; G. W. Bolster, Lockland, Ohio. App. filed Dec. 19, 1898. Two disks are pivotally mounted and grip the wire between them, with springs acting on each disk to maintain a suitable gripping action.

638,703. ELECTRIC ARC LAMP; W. J. Corcoran, Leroy, N. Y. App. filed Jan. 23, 1899. The carbons stand at an angle to each other and clutches engaging each are attached to a common armature which is adapted to move the carbons equally.

638,705. ELECTRIC SWITCH; J. L. Creveling, New York. App. filed Jan. 24, 1899. The contacts are located upon opposite sides of an insulating plate by means of which they are separated a sufficient distance to prevent arcing.

638,753. ELECTRIC GAS LIGHTER; F. N. Pike, New York. App. filed Feb. 16, 1897. Two electrodes are arranged so that one is movable toward the other to close the circuit and then break contact therewith at a point close to the point of exit of the gas. This is done without the use of springs.

638,754. ELECTRIC GAS LIGHTER; F. N. Pike, New York. App. filed Feb. 16, 1897. A modification of the preceding.

638,782. ELECTRIC BLOCK SIGNAL SYSTEM FOR RAILWAYS; L. C. Werner, Louisville, Ky. App. filed Oct. 7, 1898. Semaphores or signals at the side of the track, operated automatically by the movement of the trains in turn, operate a register in the cab of the locomotive to show whether the train has properly or improperly passed a signal.

638,788. ELECTRIC ARC LAMP; E. Woltmann, New York. App. filed Oct. 25, 1898. In accordance with this invention the means for separating the carbons is normally inactive and remains inactive while the armature is being attracted to its magnet, but becomes fully active after the armature has been attracted and continues active until the arc has been fully established. This is to prevent flickering.

638,789. ELECTRIC ARC LAMP; J. J. Wood, Fort Wayne, Ind. App. filed Aug. 25, 1898. To adapt a clutch feed mechanism to an alternating current lamp the inventor suspends the armature of the regulating mechanism in such manner that its vibrations are not transmitted to the clutch while its bodily movements under the control of the magnet are effectively transmitted.

638,803. VAULT FOR SUBTERRANEAN CONDUITS; E. G. Edwards and C. E. Phelps, Baltimore, Md. App. filed April 17, 1899. The manhole leading to the vault is made circular at the top and elliptical at the bottom of its frame; this enlarges the opening in one direction so that a man on a ladder can pass through without difficulty.

638,833. ELECTRIC LIGHT SOCKET; L. M. Shapman and G. Gellatt, Louisville, Ky. App. filed May 6, 1899. Details of construction.

638,836. ELECTRIC ARC LAMP; W. J. Davy and G. Thomas-Davies, London, England. App. filed June 6, 1898. An alternating current enclosed arc lamp, in which the invention pertains to the details of construction affecting particularly the arrangement of the idle resistance, the cut-out and the devices for obtaining the closure.

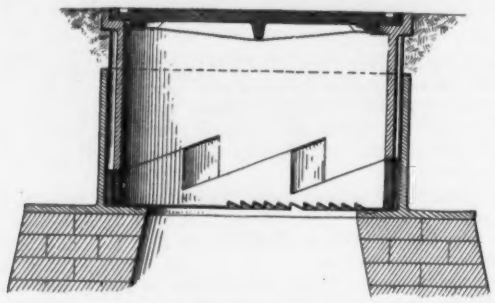
638,837 and 638,838. PENCIL FOR INCANDESCENT LAMPS; R. A. Fessenden, Allegheny, Pa. Apps. filed Aug. 25, 1899. (See Current News and Notes.)

638,839, 638,840 and 639,161. INCANDESCENT LAMP; R. A. Fessenden, Allegheny, Pa. Apps. filed Aug. 25, 1899, and Aug. 7, 1899. (See Current News and Notes.)

638,859. SWITCH FOR ELECTRICALLY PROPELLED VEHICLES; P. H. White, Indianapolis, Ind. App. filed May 15, 1899. The battery cells carry certain contacts and corresponding contacts are attached to the frame of the vehicle, a rotary shaft is arranged with wings adapted to engage the said contacts and thus electrically connect or disconnect the batteries with the working circuit.

638,872. MULTIPOLAR ELECTRIC MOTOR; C. Lindstrom, Chicago, Ill. App. filed Oct. 16, 1899. The coils of the motor are held in place by radially disposed devices bearing upward against the ends of the said coils.

638,874. SUPPORTING DEVICE FOR BATTERY ELECTRODES AND CUPS; R. Macrae, Baltimore, Md. App. filed April 8, 1899. Supporting devices operating to independently and removably connect and separate the battery elements and their cups, consisting of a cross frame with a series of



638,692.—Manhole for Electric Conduits.

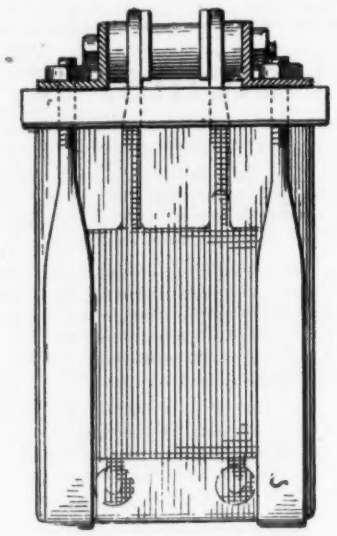
insulated bars therein, conducting means between said bars, a pair of electrodes hung on each side of the bars, a depending frame detachably supported from the cross frame and adapted to support the jars.

638,895. ELECTRIC TREE; G. H. Wallace, San Francisco, Cal. App. filed Sept. 21, 1899. A cable carrying many wires forms the trunk of the tree and the wires are lead off to form branches, each of which carries a lamp at its extremity. The device is intended for advertising purposes.

638,933. ELECTRIC GENERATOR FOR GAS ENGINE IGNITERS; B. McInnerney, Omaha, Neb. App. filed June 10, 1899. In connection with the generator a permanent magnet is used having laminated wire-wound poles and a keeper, means being provided for carrying one past the other to first reduce the magnetic flux and then increase it suddenly to a maximum. The idea is that with this device the generator is adapted to engines in which there are variations in timing the spark.

638,986. TARGET; E. F. G. Pein, Hamburg, Germany. App. filed June 20, 1899. The target is divided up into yielding sections, which are connected by circuits with an indicator at the firing position to show where the target is struck.

638,992. INDICATOR FOR ELEVATORS; G. Rowntree, Chicago, Ill. App.



638,874.—Supporting Device for Battery Electrodes and Cups.

filed Feb. 10, 1898. This is a device for indicating to persons on a landing the approach of an elevator and consists of a contact device moving in unison with the car and closing circuits to energize a signal ahead of the car.

638,019. ELECTRIC CLOCK; J. Butcher, Jersey City, N. J. App. filed May 18, 1899. Details of construction whereby lifting of a weight by means of a magnet is applied to a movement wherein the escapement is controlled by a balance wheel and hairspring, instead of a pendulum.

639,053. ELECTRIC RECORDING SYSTEM; C. J. Jaeger, Maywood, N. J. App. filed Feb. 8, 1898. With this apparatus a continuous record is made on one strip of paper of the direction, distance, speed, time, variations of and signal used during a vessel's movement. The invention resides in the circuits and combinations of devices used.

639,062. ELECTROMAGNETIC APPARATUS FOR SEPARATING ORES; E. Kreuser, Mechernich, Germany. App. filed Feb. 28, 1899. A pair of cylindrical electromagnets having at least three cylindrical poles of larger diameter than the intermediate parts on which the coils are wound, the two end poles being of the same polarity while the intermediate pole is the opposite polarity, and one of the sets of poles being made of larger diameter than the other, so that such larger poles of one magnet are in contact with those of the other, while the polar distance between the smaller poles constitutes a magnetic field for the separation of the ores.

639,124. ELECTRIC ALARM OR SIGNAL; H. Wilds, Johnstown, Pa. App. filed Oct. 7, 1899. Contacts are arranged in the plane of travel of a index so that a signal will be given at various points with which the position of the contacts corresponds.

639,127. SWITCH FOR ELECTRIC TRACTION SYSTEM; O. Zoedicke, Muhlhausen, Germany. App. filed April 28, 1899. An overhead trolley switch designed to prevent the wheel from running off the wire while passing the switch.

639,147. GALVANIC TRUSS BODY; S. S. Carpenter, Boston, Mass. App. filed April 24, 1899. The body portion of the pad is of insulated material and to the face of this is secured a metallic sheath by means of pins of metal having a different position in the electrical scale, so that the fluids of the body acting upon the two metals will create a galvanic action.

639,170. MEANS FOR CONTROLLING ELECTRIC HEATERS; E. E. Gold, New York. App. filed March 10, 1897. A rotary shaft adapted to connect any number of the resistance coils of a heater in multiple circuits.

639,186. SYSTEM OF AUTOMATIC TELEPHONE EXCHANGES; G. Seligmann-Lui, Paris, France. App. filed May 27, 1898. (See Current News and Notes.)

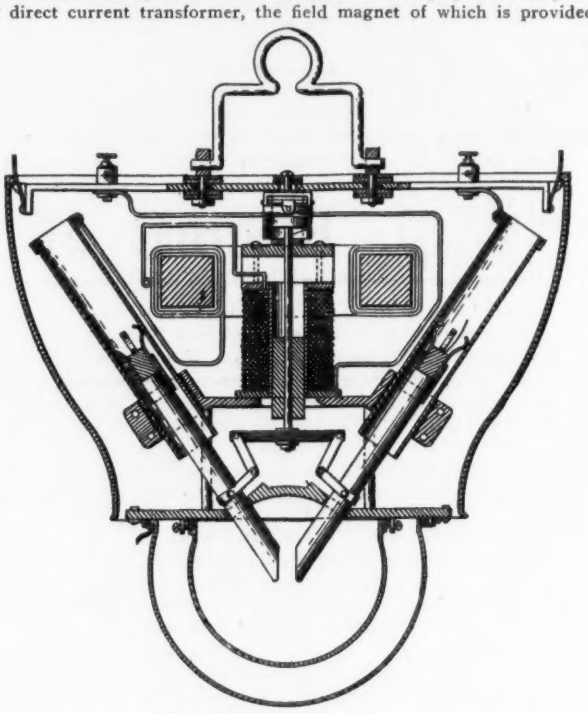
639,195. ELECTRIC SWITCH; W. Ely, Providence, R. I. App. filed March 14, 1899. This is a double throw quick break system, wherein means are provided for the primary storage of sufficient energy to cause the automatic transfer of the contact member from one side of the terminals to the opposite side and means for intercepting the contact member in its flight at the will of the operator.

639,202. SIGNALING SYSTEM AND APPARATUS FOR ELECTRIC TROLLEY RAILWAYS; W. R. Stearns, Portland, Ore. App. filed July 30, 1899. The signals are set by the trolley arm striking certain levers projecting in its path; this operates circuits to move the signal.

GERMAN PATENTS, ISSUED NOV. 29, 1899.

[In Charge of Dr. Ralph Julian Sachers, 120 Liberty Street, New York.]

105,460. METHOD OF INFLUENCING THE CURRENT LAG IN ALTERNATING CURRENT CIRCUITS; Westinghouse Electric Company, London. App. filed Nov. 24, 1896. In order to decrease the lag of current by means of suitable synchronous motors, there is employed a rotary alternating direct current transformer, the field magnet of which is provided with



638,703.—Electric Arc Lamp.

main and shunt windings, so that increasing load of the direct current circuit on account of a density increase in the magnetic field decreases the lag of the current in the alternating current circuit.

105,461. DEVICE FOR INDICATING LEAKAGES IN ELECTRIC CIRCUITS; O. Krueger & Co., Berlin. App. filed May 28, 1898. The difference in current between a point in front and one behind the defect of a certain conductor, corresponding to the leakage, is registered on a suitably arranged galvanometer.

105,542. ELECTRIC ARC LAMP; Daniel Lacko, Paris. App. filed Jan. 25, 1898. The regulation of this lamp consists in the rotation of a vertical gear wheel, operating the carbon carriers. This rotation is produced by means of an endless screw, which is rotating by an electromagnet in shunt to the main circuit.